June

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THE END OF THE WORLD

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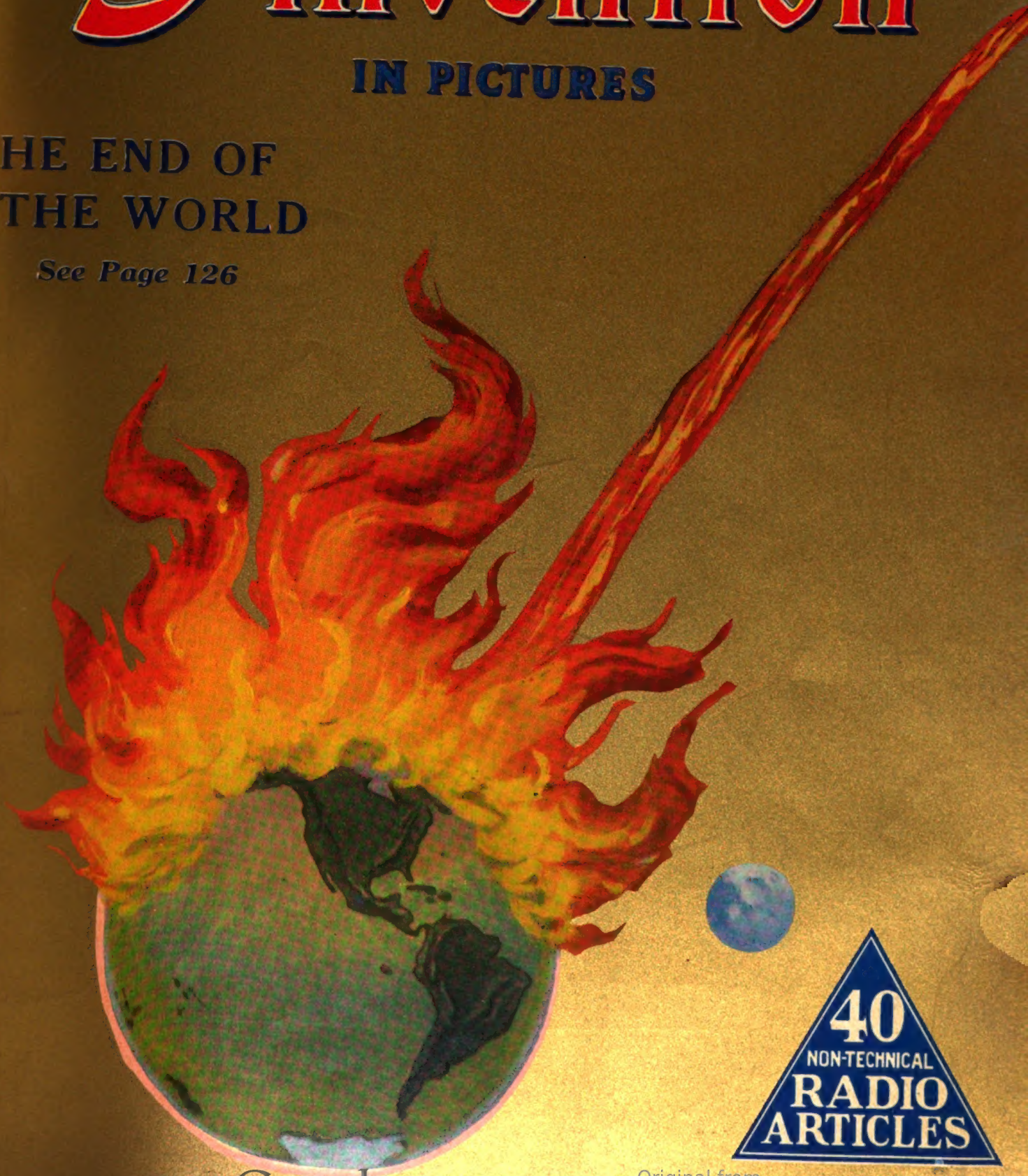

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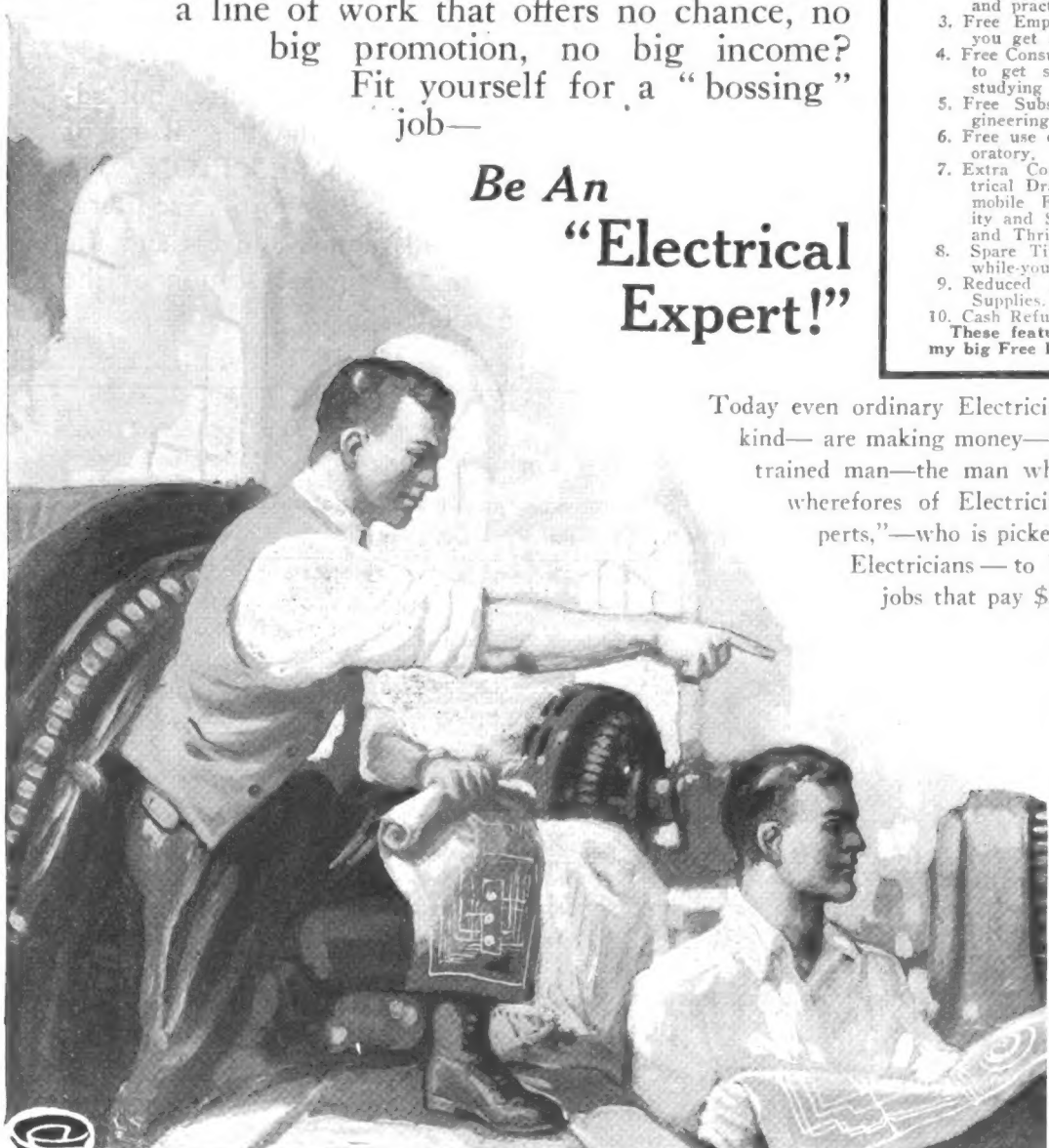

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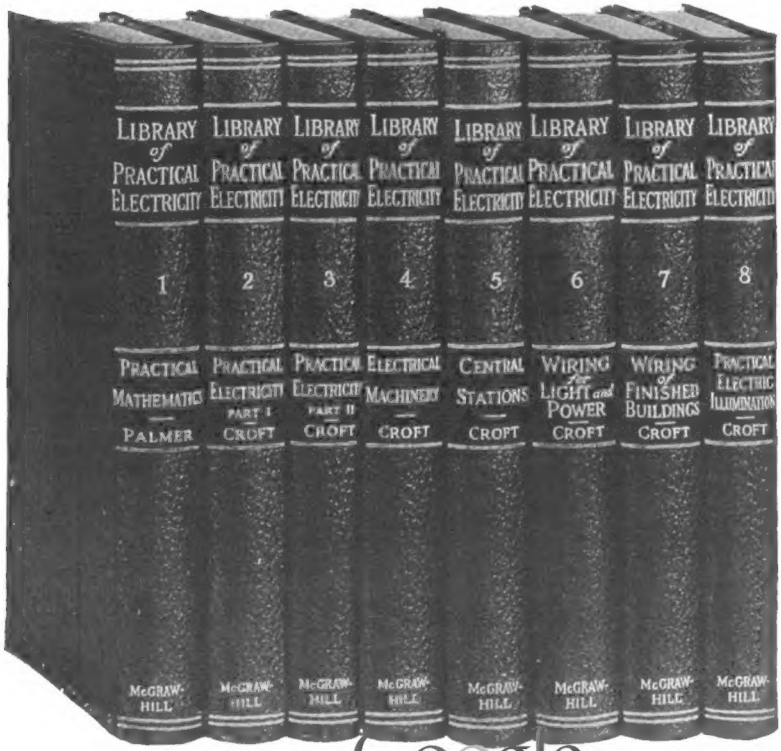
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Great Inventors Now Teach You Secrets of Practical Inventions

How would *you* like to be the inventor of the tin cap that now corks millions of bottles—and who gets a royalty on every one? How much money would *you* have now if you had invented the simple idea of putting a rubber tip on pencils? The inventor of the Gillette Safety Razor is said to have made as high as $2,500,000 *a year!* The inventor of the tiny snap fastener last year paid an *income* tax of $29,000. The man who invented the Autographic Kodak sold his patent rights for $500,000!

Little inventions like these have brought fortunes to their inventors

JUST a single idea can make *you* independently wealthy in a short time. Little things—like the crimped hairpin, the paper safety-match, the metal-tip shoelace—brought their inventors hundreds of thousands of dollars. Only recently *Success Magazine* told how one woman built up a splendid business from an invention based on a little wedge-shaped piece of wood!

Couldn't *you* develop an invention as simple as these? Haven't *you* some ideas—even now—for one of these little inventions which can pay you so much money?

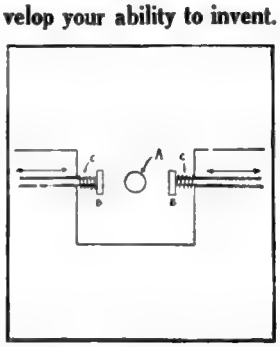
What Invention Is

After all, invention is nothing more than the science of "fixing things." And how many times a day you do "fix things." A leaky faucet, a rattling window, a broken strap—you fix hundreds of things just like these almost every day. You may not know it, but when you "fix things" you are using the principles upon which Inventive Science is based.

Prove it for yourself. Here is shown a very simple problem in invention. See how quickly you can solve it. What would you put on Shaft "A" to force members "B B" to move back? Think of something you know now which can give you the answer. If you have an ordinary electric light switch you will find it in a second.

Invention is not guesswork or blind luck—it is not a God-given faculty possessed by a few favored mortals. The truth is that invention is based upon exact laws which anyone can learn. It is merely a matter of first *seeing* something to be fixed and then of thinking of some principle which will fix it.

This test shows how easily you can develop your ability to invent.



Here is an interesting little problem and its solution will be found very simple, if we really think hard.

"A" is the end of a shaft. The two members "B B" are free to move in either direction indicated by the arrows. If they are pushed back, the springs "C C" will immediately pull them forward again. Our problem is to put some kind of an attachment on the revolving shaft "A" so that the members "B B" will be pushed back both at the same instant every time the shaft "A" makes a single revolution. The device on shaft "A" must also allow the two members "B B" to come forward once in every revolution. What would you suggest putting on the shaft "A"?

That's all. The whole thing rests on being able to think inventively. The simple problem shown here proves that when you think inventively the whole science of invention becomes as easy to learn as reading or writing.

Why More Inventions Are Needed Now

Raymond F. Yates, who with fourteen other famous inventors now makes it easy for you to learn how to invent in your spare time at home.

Hundreds of years ago, the world didn't need many new things. That is why few inventions were made each year. But now the world has more needs, more things to be "fixed." And that is why, in the United States alone, over 50,000 inventions are patented every year!

The world wants better and cheaper light and power. It wants an electric light that will be heatless. It wants new motors that will weigh less and produce more power. It wants faster and less costly aeroplanes, motor cars, steam engines. It wants new inventions which will make cooking and housework easier; that will save time and labor in the home, the farm, the factory and the office. It wants new ideas for toys and other amusements. It wants its present inventions to be developed so that they will work better and more economically.

Surely you have at least one idea for an invention—no matter what it is—no matter how great or how small—the world will pay handsomely for even the simplest idea. Every day you see things which can be improved or which must be "fixed." Every day you can get ideas for new inventions. It can be a new kind of mechanical toy, or some device which will make your wife's housework easier. It can even be something as simple as the common nutcracker. The man who invented the Kiddie-Kar, it is reported, made over $5,000,000!

What Edison Says

Could you ask the advice of any greater authority than Thomas A. Edison? He says: "INVENTION IS A SCIENCE AND SHOULD BE TAUGHT AS A PROFESSION."

And now, for the first time, you can profit by Edison's advice. You can actually learn invention as a profession—exactly as other people are learning electricity, automobile mechanics, law, medicine, as a profession. The Bureau of Inventive Science offers you the first course in practical invention ever devised, it has written down the easy-to-learn principles of Inventive Science so everybody could read them and learn to use them. You want the ability to invent—NOW. All you need, to become successful is this easy, fascinating training which will develop your ability so it will be worth real money.

Learn Invention by Actual Practice at Home

Hitherto inventors had to work out the principles of invention alone. But at what a terrific price in long years of discouragement, lost time, wasted money! Now you can quickly learn, in your spare time at home, the secrets of invention which brought wealth and fame to Edison, Marconi and other great inventors.

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New FREE Book

The most fascinating part of this great new course is that it teaches invention by actual practice, right in your own home. With each lesson you are sent some problem in invention—just like the one you worked out here. This fascinating exercise in solving actual problems in invention, sharpens your instinct to fix things. Better than anything else, it gives you an unforgetable, instinctive habit of thinking inventively, which is worth more than you realize. In fact the lessons and exercises are so simple, so easy to understand, so interesting, that they seem more like a pleasant game than like instruction which can make you a successful inventor.

A wonderful new book, just printed, tells you more about the Bureau of Inventive Science and its simple new course in invention. It explains in detail just how this course develops your ability to invent. It tells you how great inventors work, how to develop your ideas, how to get a patent, how to protect your invention, the best way to sell your invention, how to convert a simple little idea into big money, how to learn all the secrets of successful invention. It costs nothing, so send the coupon at once. This bureau is not connected with patent attorneys or manufacturers. Its only purpose is to teach you the principles of practical invention used by every successful inventor. Write for the FREE BOOK now.

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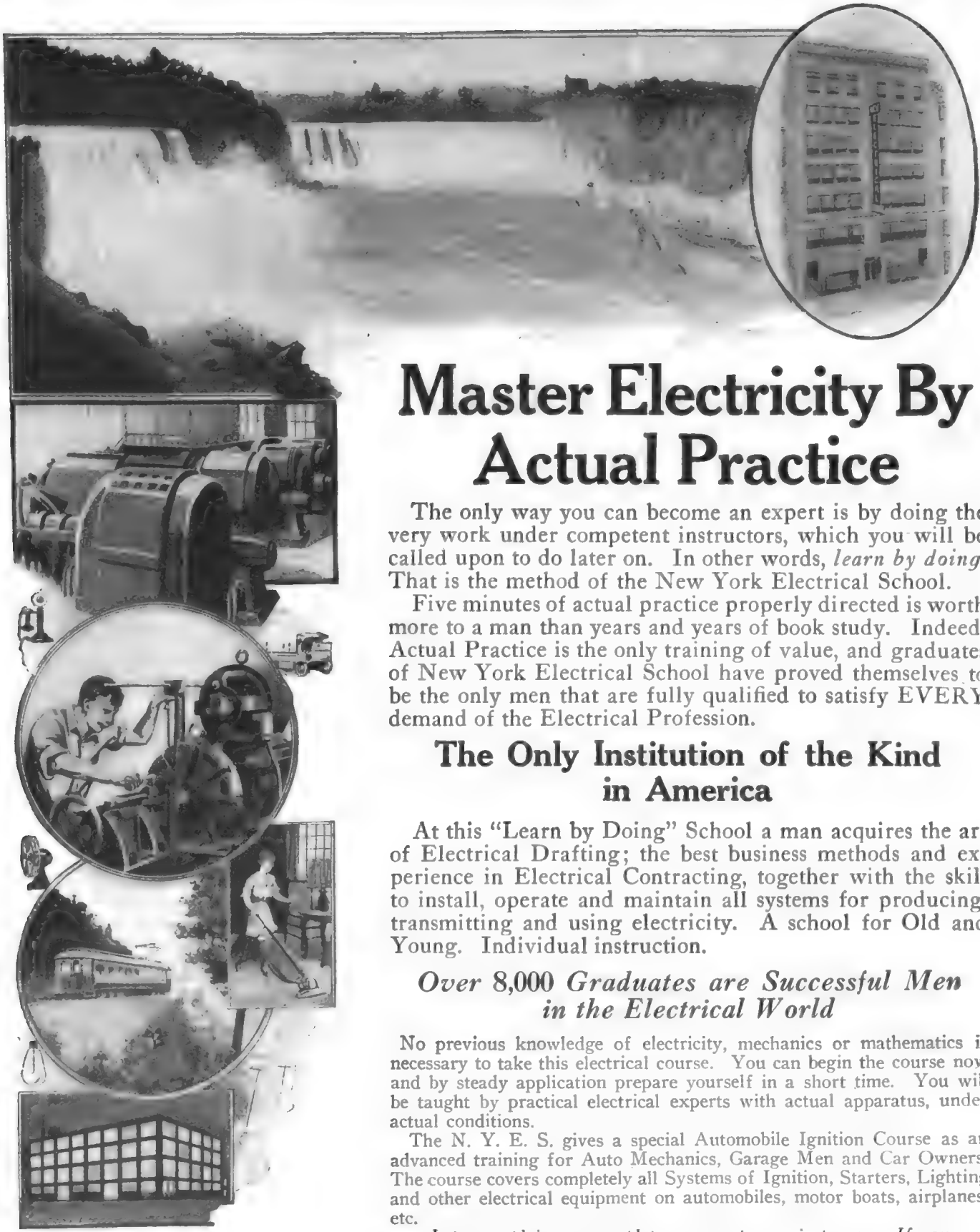

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T. O'CONOR SLOANE, Ph.D., ASSOCIATE EDITOR

Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

Invisible Worlds

By HUGO GERNSBACK

A FISH swimming in its natural medium,—water,—is not aware of the water itself. He does not know of its existence. A young child living in its natural medium,—air,—is not aware of it anymore than the fish is of his medium. The child breathes air and only as it becomes older does it know that there is such a thing as atmosphere surrounding it on all points. Even the intelligent grown-up human being is not apt to appreciate the fact that he is living in many other media aside from air. Only as we advance in our knowledge do we appreciate the tremendous forces that surround us from all sides, and which being invisible and intangible to our senses, do not seem to exist for us.

I BELIEVE

¶ THAT our senses should not be trusted too much these days.

It took humanity millions of years to eradicate the huge monsters and wild beasts that preyed upon us, but the far greater enemies, floating in the air about us, the invisible ones, such as microbes will not be so fully eradicated, for the reason that we cannot see them. Fighting an unseen enemy is always the harder task.

We inhale microbes and other organisms by the billion all day long, and these are live organisms. Aside from this we breathe in other matter such as dust particles in tremendous quantities, invisible also to the naked eye. Furthermore, we also breathe in not only the natural gases contained in the atmosphere, but all sorts of other gases, some of these beneficial, others harmful to our respiratory organs.

I BELIEVE

¶ THAT the world is governed by invisible, rather than by visible forces.

Atmospheric researches as far as human beings are concerned, will play a tremendous rôle during the next few centuries. Once we understand all that lies in this invisible world—our atmosphere—our lives will be very much improved.

Not only are we submerged in an atmospheric ocean, but the atmosphere itself floats in a world of waves which might be called vibrations, or electro-magnetic impulses. Our all-dominating sun, which controls everything on our planet, shoots down to us visible light. This visible light however is accompanied by myriads of invisible rays which are only brought to our senses in an indirect manner and sometimes not at all. The sun's rays contain not only light rays, but chemical rays as well. Thus the sun's spectrum contains at one end ultra-violet rays, and at the other end infra-red rays. These obscure heat and chemical rays have only been studied during the past century and are now being made use of for the benefit of humanity. On the other hand, many of our scientists suspect that outside of the ultra-violet and infra-red rays, there must be other rays of some other nature which are only as yet suspected, lying in an invisible world of which we as yet have no knowledge. But we do suspect that such rays may have something to do with gravitation and the holding together of the entire universe. The opening of this particular invisible world will probably mean the entire emancipation of man from all slavery. By this is meant that as long as we are chained to this planet by means of gravitation all work is difficult of performance. All manual tasks, the working of all machinery, the hauling of all loads will all be facilitated tremendously once we understand the workings of invisible gravitation.

I BELIEVE

¶ THAT only truly great minds realize their limitations.

While you are reading these lines, spoken words, music, and other sounds pass right through your body without your suspecting it in the least. These radio waves that pass through practically all obstacles are also electro-magnetic waves and also belong to that invisible world. We cannot hear or feel the music that is constantly traversing our bodies, because our senses are not tuned to such waves. This leads us to the interesting speculation—how many other forms of invisible waves are there all about us at every second of the day, all unknown and unsuspected by us? We know that there are many unexplored sections of the electro-magnetic spectrum to which light, radio waves, sound waves, X-rays and radio waves and many others belong. All these are tremendous influences, that may shape our very destinies and about which we do not even dream today, due to our total ignorance.

Space itself, which surrounds us and our whole universe, is invisible. This, however, does not mean that due to this invisibility it is empty. Space contains myriads of dead suns and their planetary systems which we no longer see due to absence of light. It is possible that in the future science will make such worlds visible to us.

It is safe to say, that during the next 100 years scientists will concern themselves chiefly with the exploration of the invisible world. We will then reverse the old adage—"Seing is Believing" into *"Not Seeing is Believing."*

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Fire Fighting

Water Veil Protects Building

By R. G. THACKWELL

·FIRE SYSTEM·
92 WATCHMAN'S CLOCKS
49 FIRE ALARM BOXES
5000 FT. OF 1½" HOSE
100 FIRE EXTINGUISHERS
195 FT. OF STANDARD HOSE

By providing a curtain of water which entirely surrounds a gigantic office building in Cincinnati, a protection against exterior fire hazards has been obtained. In 1922 fire leaped across an eighty foot street and damaged property in several upper floors of a Chicago skyscraper. Engineers then realized that office buildings must be equipped with fire fighting apparatus to protect them from fire from without as well as within the building. The photo at the right shows how the building is protected by its curtain of water.

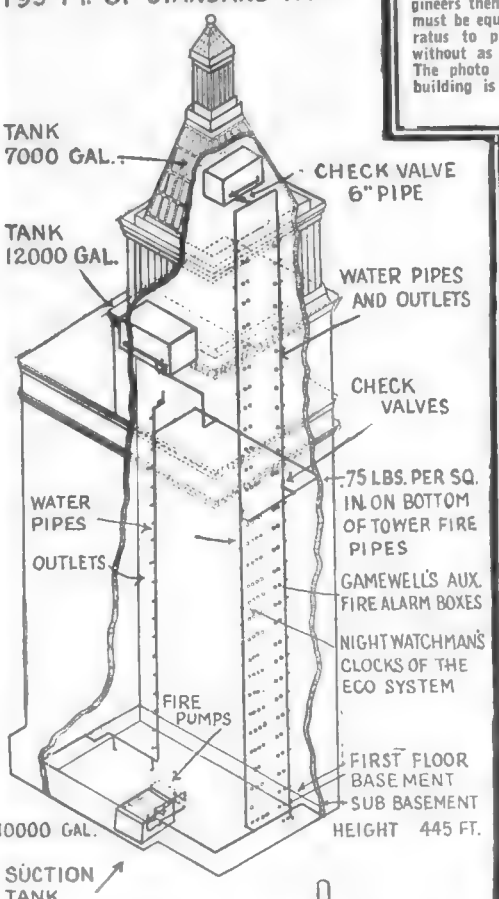
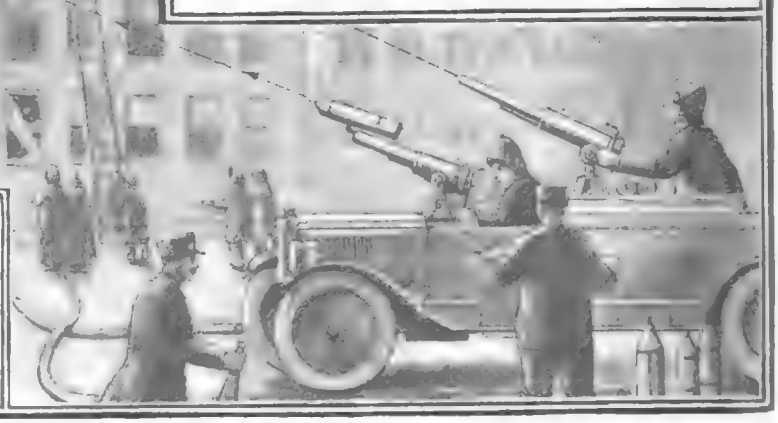
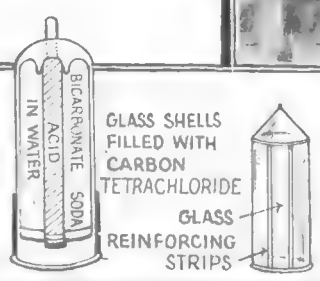


Photo above shows the pumping plant in the sub-basement of the building. These pumps when in operation furnish 2,550 gallons of water per minute. There are two six-inch connections, so that the fire department can connect eight two and one-half inch hoses to the system and pump directly from the street. Below is the fire extinguishing system designed by a captain in New York Fire Department, Hugh T. Dunn. This is a fire extinguishing shell made of glass or thin metal, and filled with either carbon tetrachloride or a sodium bicarbonate and acid solution. The shells are fired into the flames as illustrated below.



Above diagram shows the arrangement of the sprinkler system in the Union Central Building. Right, shells containing fire extinguishing solutions which break when they strike a hard surface. An extension on the shell fits into the gun nozzle.



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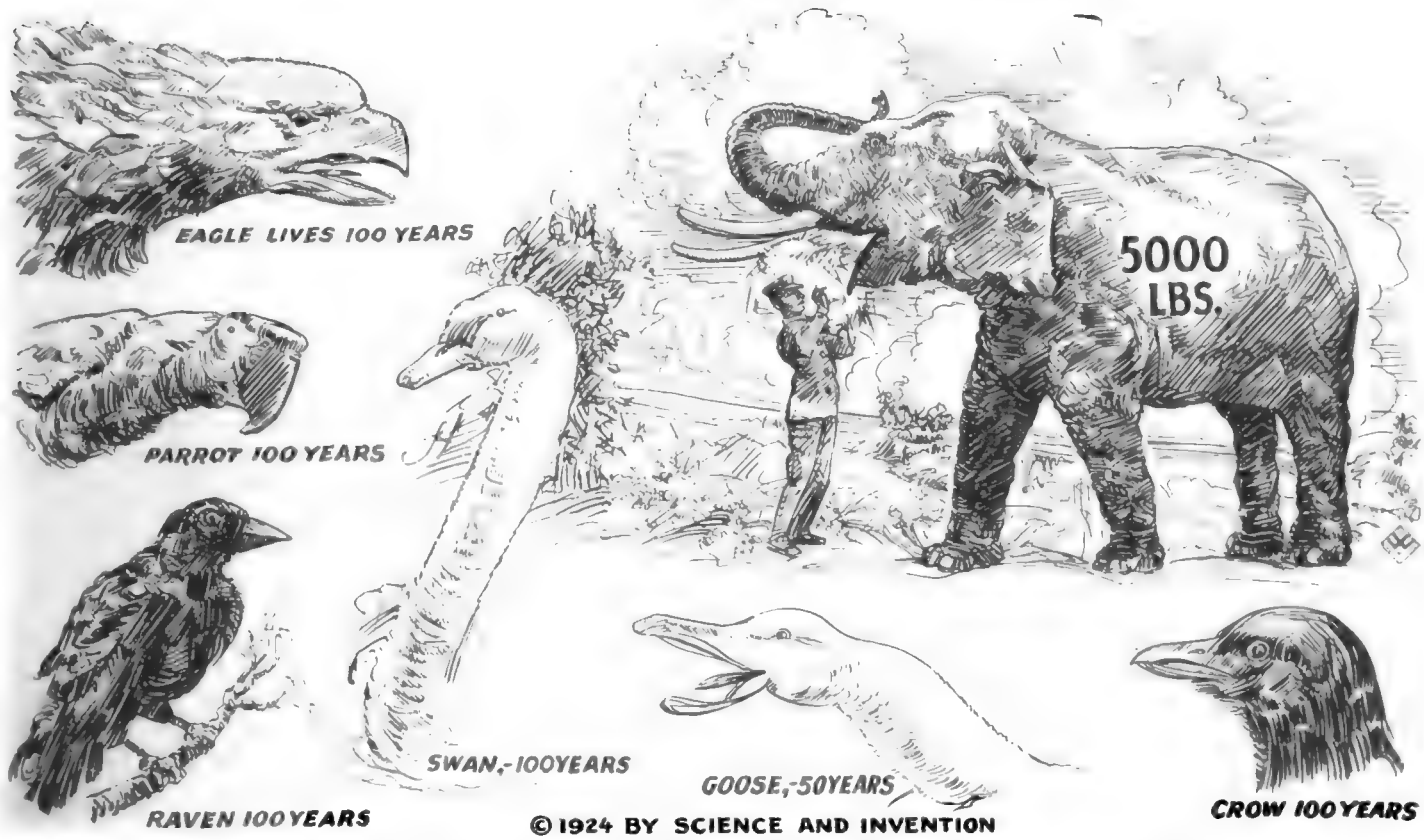
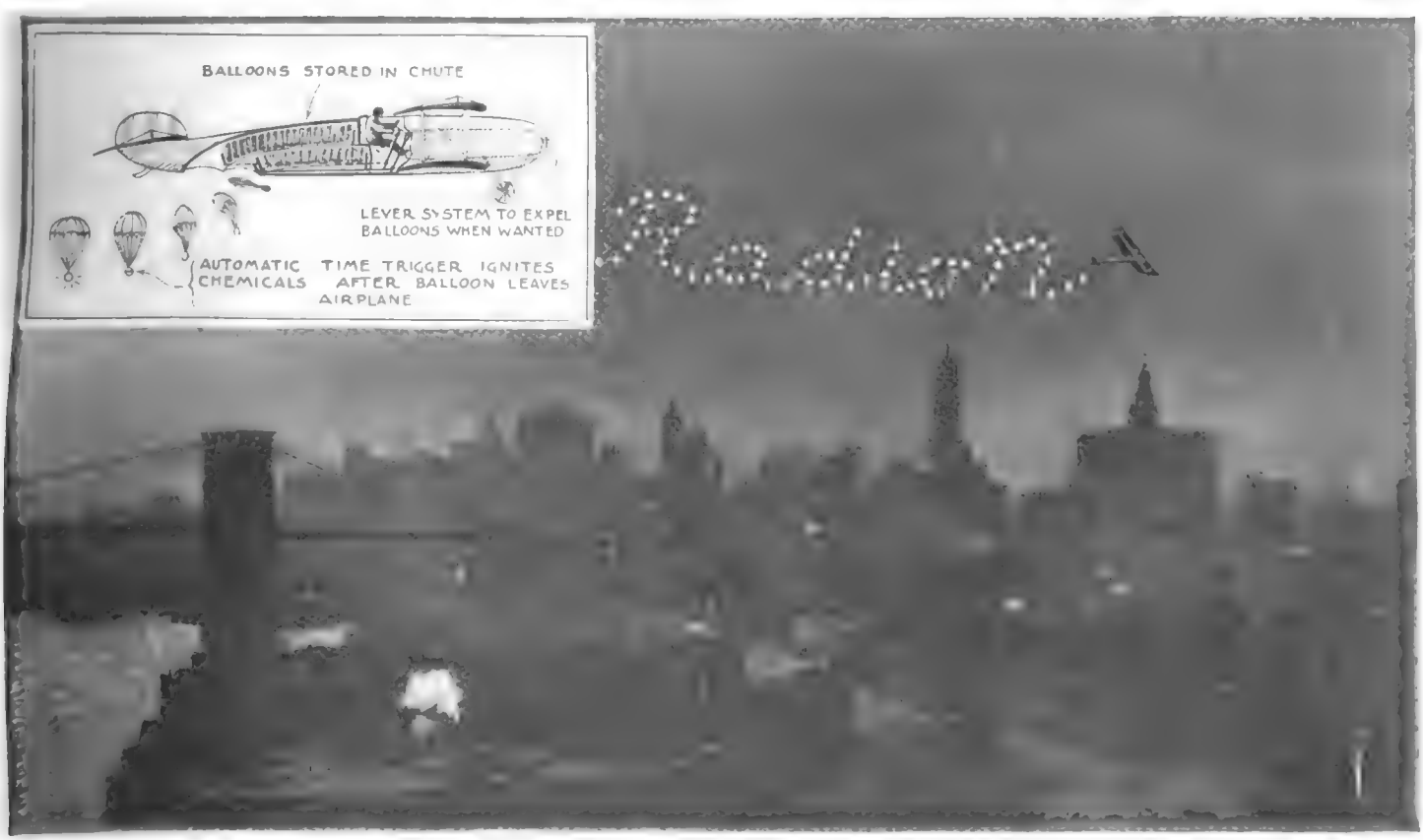
The Life Span of Beasts



Above is given the lives of some beasts and birds. Notice that many ordinary fowl have a much longer span of life than man. A small elephant weighs about 5,000 pounds. Almost every one consumes 2,500 pounds of food and drink a year, and some consume as much as 4,500 or 5,000 pounds, the weight of a fair sized elephant.

New Method of Aerial Advertising


BALLOONS STORED IN CHUTE
LEVER SYSTEM TO EXPEL BALLOONS WHEN WANTED
AUTOMATIC TIME TRIGGER IGNITES CHEMICALS AFTER BALLOON LEAVES AIRPLANE

One of the most novel advertising features seen lately was obtained by releasing balloons from an airplane as it flew in a course which spelled out words. Each balloon supported a small pot of chemicals which were automatically ignited after it was released from the plane. The chemicals gave a bright flare of light, forming the words.

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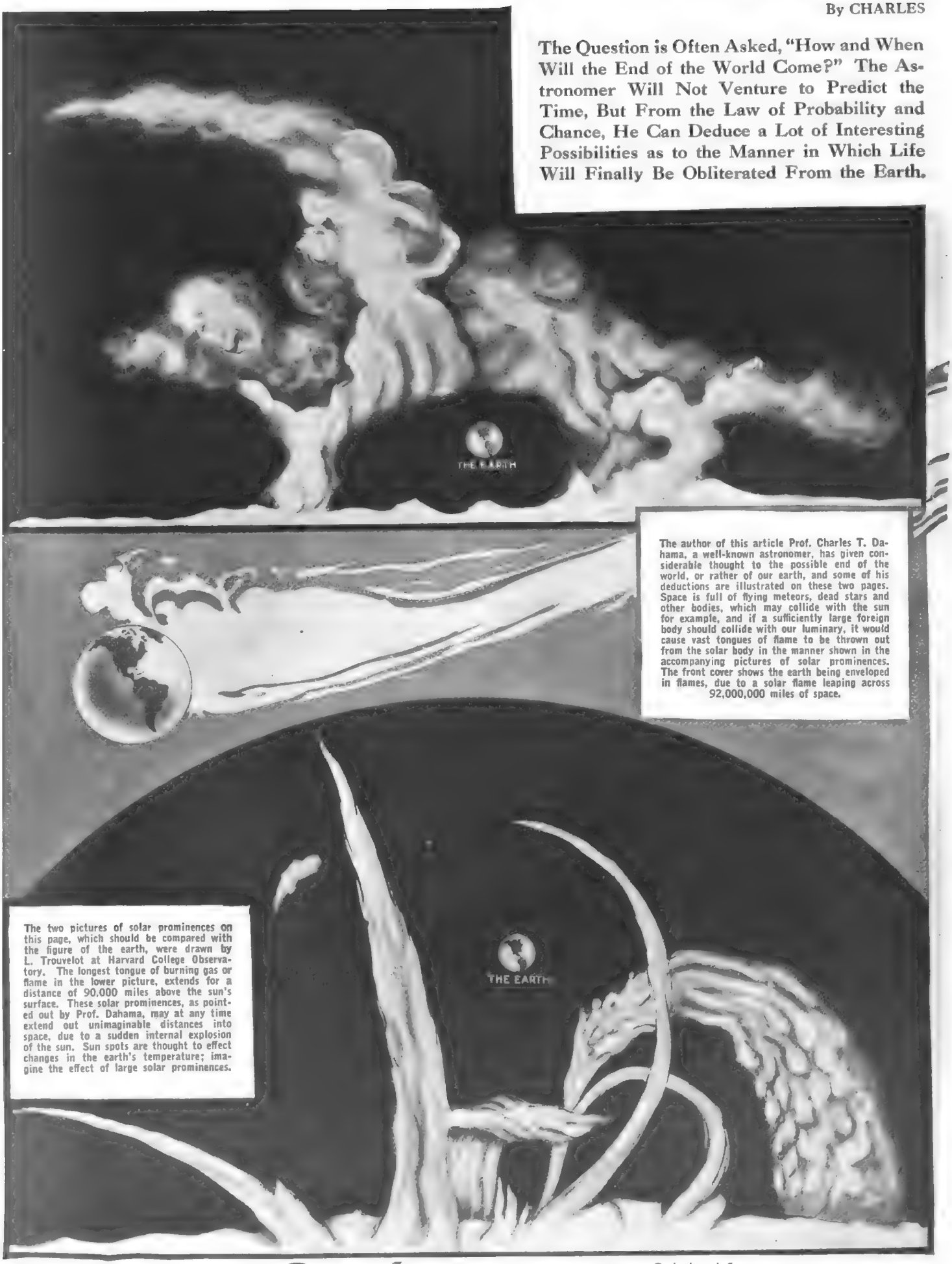
The End of

By CHARLES

The Question is Often Asked, "How and When Will the End of the World Come?" The Astronomer Will Not Venture to Predict the Time, But From the Law of Probability and Chance, He Can Deduce a Lot of Interesting Possibilities as to the Manner in Which Life Will Finally Be Obliterated From the Earth.



The author of this article Prof. Charles T. Dahama, a well-known astronomer, has given considerable thought to the possible end of the world, or rather of our earth, and some of his deductions are illustrated on these two pages. Space is full of flying meteors, dead stars and other bodies, which may collide with the sun for example, and if a sufficiently large foreign body should collide with our luminary, it would cause vast tongues of flame to be thrown out from the solar body in the manner shown in the accompanying pictures of solar prominences. The front cover shows the earth being enveloped in flames, due to a solar flame leaping across 92,000,000 miles of space.

The two pictures of solar prominences on this page, which should be compared with the figure of the earth, were drawn by L. Trouvelot at Harvard College Observatory. The longest tongue of burning gas or flame in the lower picture, extends for a distance of 90,000 miles above the sun's surface. These solar prominences, as pointed out by Prof. Dahama, may at any time extend out unimaginable distances into space, due to a sudden internal explosion of the sun. Sun spots are thought to effect changes in the earth's temperature; imagine the effect of large solar prominences.

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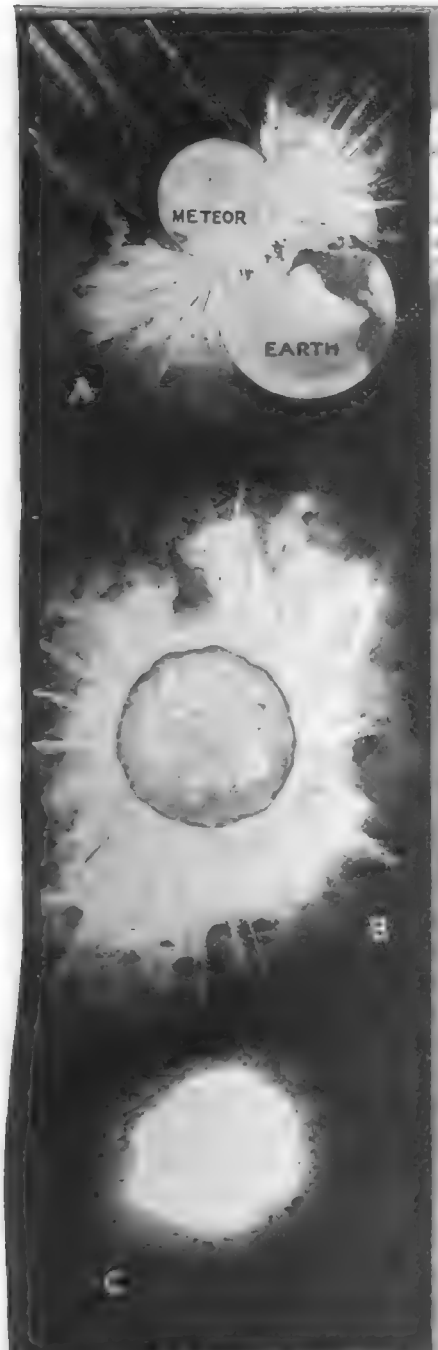
the World

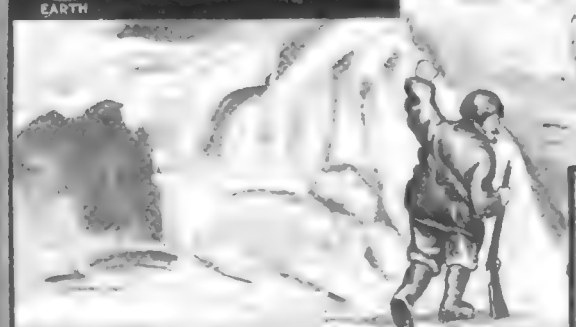
T. DAHAMA

Life is a Gamble. Will the Sun Hit Another Star and Cause a World Cataclysm? The Astronomer Says This May Occur—Sometime Within the Space of 1,000,000,000,000,000,000 Years—But With That Length of Time Ahead of Us There is Small Chance of Its Ever Occurring Before Some Other End Befalls Us.

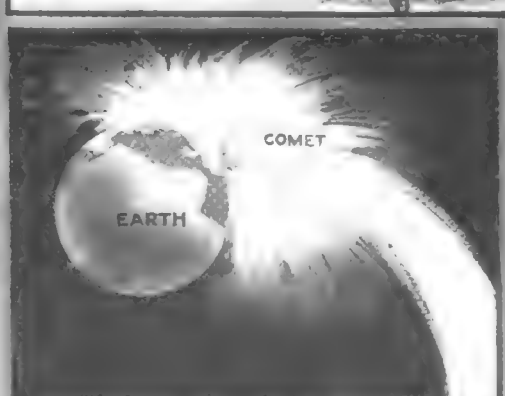


If a meteor as large as the earth collided with our planet, the sky would blaze red; the force of the impact as the huge spheres crashed together, would fuse them, (stage B above). The oceans would vaporize and an explosion would follow that would obliterate the earth's present form. Three seconds after the first shock, the earth would be a shapeless mass of molten metal covered with steam. (Stage C)

If a wandering meteor or dead star as large as the earth should fall into the sun, enough heat would be generated to double the sun's heat. The pictures above show how a temperature of 200° to 300° on earth would scorch the ground, and cause the waters to boil. Vegetation would disappear in a few days and man himself would disappear in a few years. The upper picture and front cover show solar flames reaching the earth.



The sun is slowly growing older. It will probably continue to radiate enough heat to sustain mankind, for about 20,000,000 years to come, but its final extinction is certain and with it necessarily all life. The pictures show this, the dead sun, the stars, also New York and the last survivor.



The two pictures directly above show what would happen if a giant comet should strike the earth, providing the head of the comet contains cyanogen, Prof. Dahama points out. Observation indicates that this poisonous gas is present. Cyanogen is lethal gas, recently used in the execution of criminals. In one minute all life would be extinct.

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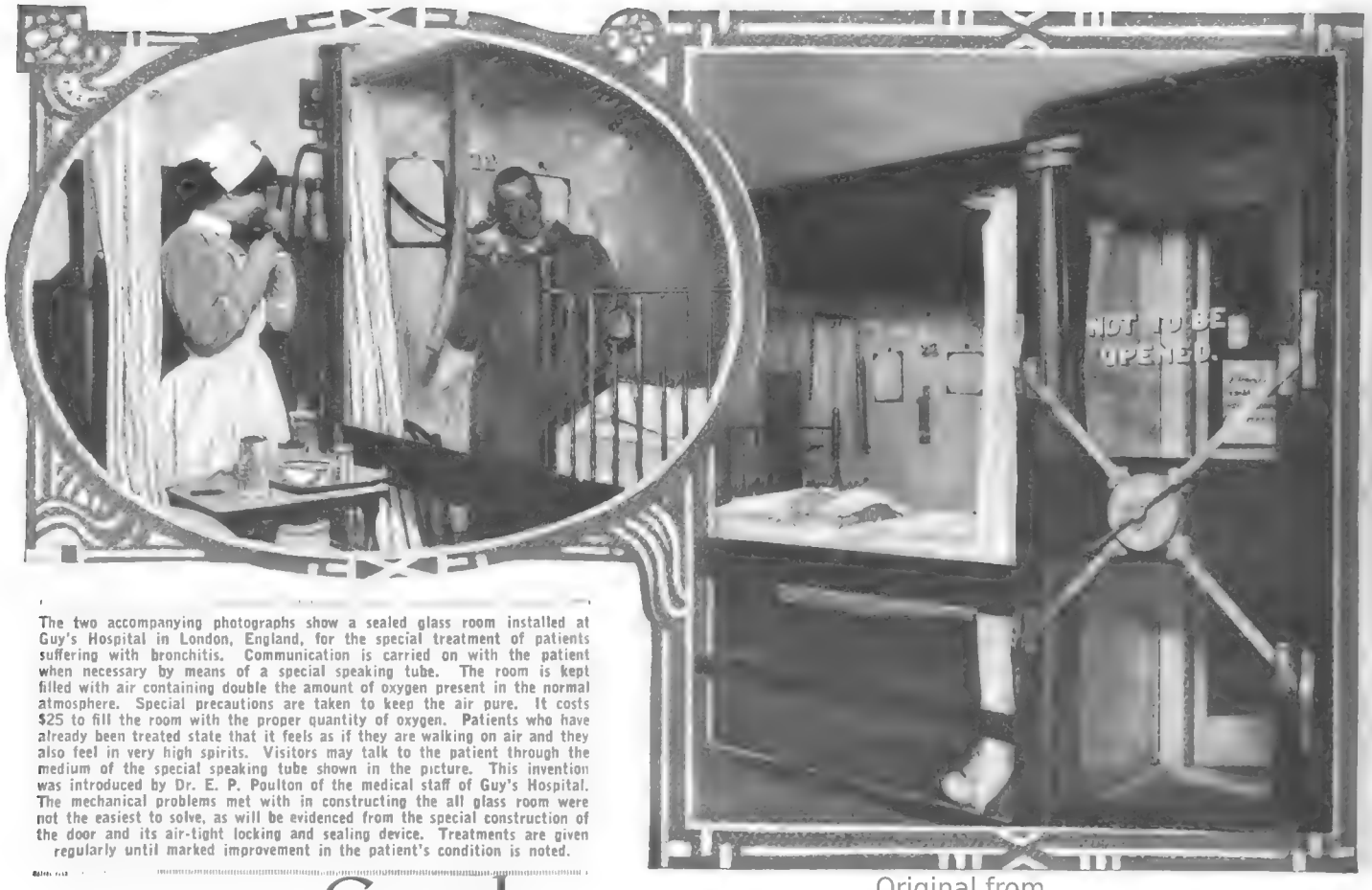
Expressing Moods In Photo Plays

A Berlin film company has recently produced a remarkable photo play in which various human moods and tempers are picturized. The theme is that a small-town man in a darkened room, having been confused by the blinking lights and the terrible noises of a great city, suddenly sees visions of the city in composite form. The picture at the immediate right, for instance, represents a railroad station. The subject seems to hear the roaring trains in the distance; then he sees a metropolitan street teeming with night life. Then he sees the entrance to a brilliant cafe, from which strains of music emanate. The composite picture of all this is seen as a grotesque laughing idiot's head.

Continuing with the description of the view at the left the image of the laughing face is intended to portray a composite of the various confusing scenes encountered in the gay night life of a great metropolis. Below is included a brilliant pyrotechnical display; feverish eyes of young city men-about-town; the blare of a jazz band and in the center of it all, a pair of lovers walking down a quiet, dark road—to illustrate the thoughts lurking in the brain of the small-town citizen. These scenes are produced by super-imposing various views from other films or photographs upon the positive film when the latter is printed.

This new type of photo-play reproducing the many thoughts surging through a man's mind is something quite new and susceptible of numerous adaptations. The picture at the left is a composite to illustrate the crossing of the railroad tracks, together with indistinct visions of a city square; a dark entrance; it all tells of a longing for far-away places, for adventures, for the unknown. American film producers will undoubtedly show us something new along these lines shortly.

Hospital Patients Kept In Glass Case



The two accompanying photographs show a sealed glass room installed at Guy's Hospital in London, England, for the special treatment of patients suffering with bronchitis. Communication is carried on with the patient when necessary by means of a special speaking tube. The room is kept filled with air containing double the amount of oxygen present in the normal atmosphere. Special precautions are taken to keep the air pure. It costs $25 to fill the room with the proper quantity of oxygen. Patients who have already been treated state that it feels as if they are walking on air and they also feel in very high spirits. Visitors may talk to the patient through the medium of the special speaking tube shown in the picture. This invention was introduced by Dr. E. P. Poulton of the medical staff of Guy's Hospital. The mechanical problems met with in constructing the all glass room were not the easiest to solve, as will be evidenced from the special construction of the door and its air-tight locking and sealing device. Treatments are given regularly until marked improvement in the patient's condition is noted.

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The Marionette Show Comes Back

Marionette Theatre Carried in Automobile

At the right Director Brann is shown at one of the stage supports with a couple of his figures.
Above is a view from Paul Brann's marionette production of the old German legend "Faust." The figures were carved by Prof. F. Bradle of Munich.
That the electrician played a more or less important part in the staging of the marionette show, may be seen by the switchboard in the photo to the left.
Here is a scene from the marionette production "The Owl Castle."
And here is a scene from a puppet adaptation of one of the old miracle plays.
MARIONETTEN-THEATER MÜNCHENER KÜNSTLER
From town to town throughout a greater part of continental Europe, Director Brann takes his complete marionette theatre. His stage is housed in the truck, shown in the above photograph while the trailer carries auxiliary apparatus.
One of the biggest hits in Mr. Brann's repertoire is Oscar Strauss' operetta "The Brave Kassian." By means of this small theatre on wheels many towns in the interior which otherwise have no entertainment, are given many an evening's pleasure.

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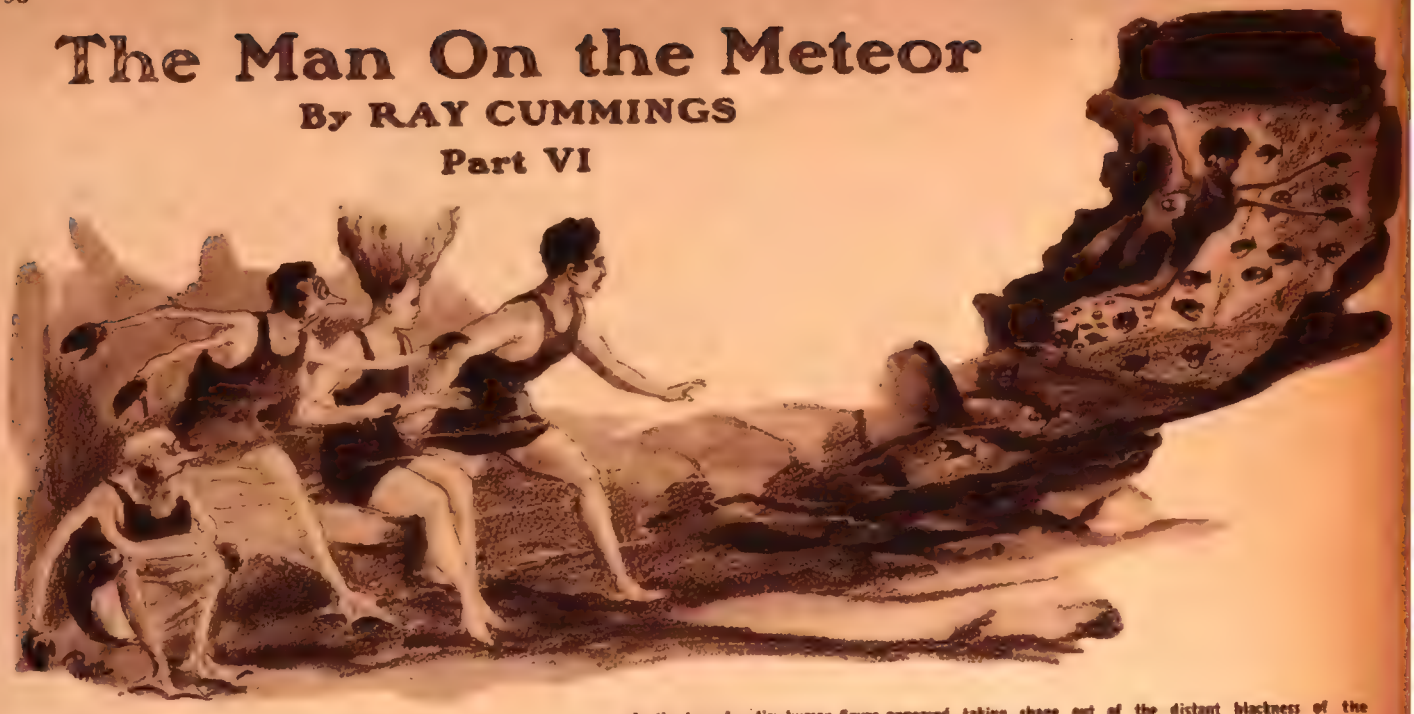
The Man On the Meteor

By RAY CUMMINGS

Part VI



In the tunnel a dim human figure appeared, taking shape out of the distant blackness of the passageway. It was swimming swiftly but silently toward us. Through the moving ranks of the black fishes circling there, it threaded its way.

SYNOPSIS OF "MAN ON THE METEOR"

WITH no memory of past events, a young man suddenly comes to his senses on a meteor which is part of one of the rings of Saturn. Being hungry and thirsty, he looks around for nourishment and finds the mouth of a cave. As he looks towards the cave a girl comes into view.

The young man who calls himself Nemo, enters the cave and after traversing some little distance finds it to be illuminated by the phosphorescence of the rocks forming its walls.

The problem of finding sufficient food became paramount in the life of Nona and Nemo. One day upon returning to the cave Nona shows Nemo several mollusks which make good food. She then takes him to the place where she found them to gather more. They wade into the stream and follow it into its cavern. Nemo sees that Nona's head is completely engulfed. Soon his head goes under water and he feels the liquid rush into his lungs. However, by violent effort he is able to breath the water. They come to a bed of shell-fish, collect enough for their needs and go back to their home in the cave. They start a fire, cook their supper and retire.

In the middle of the night they awake to find their entire cavern in flames. The rock, being of a combustible nature, has become ignited from the cooking fire. They dash toward the mouth of the cave and out to the surface of the meteor. Thus robbed of their home they "swim" through the air to the opposite side of the planet. Here they make their home beside a large stream at a point where it enters a low hill. Soon smoke and fumes from the conflagration drift over to their side of the small meteor. Nemo is suddenly seized with an idea and taking Nona with him he plunges into the water and follows the bed of the stream into the mountain. Soon they find food and devour it, still under water.

At this point they see coming toward them a party of ten people, four men and six women, who are somewhat human in form, but have four arms like the tentacles of a cuttlefish. Nemo and Nona are captured and tied by them.

They are taken by the Marinoids so-named to the city called Rax. This city is under water and, unlike the cities of our earth, is built of underwater vegetation.

After Nemo and Nona have lived with the Marinoids for some few months, Nemo becomes practically indispensable to the ruler or King of the city and is consulted by him on various occasions. The couple lived in the same home with Caan, a Marinoid, but after their child was born, whom they named Boy, they were given a home of their own. Soon after this a man named Og insulted Nemo and challenged him to a fight. The fight took place in front of the palace of the ruler and Nemo was defeated because Og had a peculiar property, which was characteristic of the Marinoids, enabling him to send a charge of animal electricity into the body of Nemo, thereby rendering him unconscious. After the fight, Nemo is brought back to consciousness by Nona. He finds, at a later date, that the electricity used was similar to that found in the body of the electric eel, common in the south. After recovering fully, Nemo starts to look for his recent adversary, but is unable to find him, and he soon learns that he has left the city.

The life of Nemo and Nona goes on happily, their baby growing rapidly in his under-water home. Nemo has been assigned to a certain amount of work in the underwater city, gathering food to be stored in the government warehouses. For a year things go along peacefully, when suddenly a daughter of one of the workers disappears. This is repeated again and again until thirty of the young women of the city have disappeared. Everyone knew, of course, that the Marinoid women were being stolen and one day a strange figure is seen in the street. Suddenly all light is obliterated and Caan and Nemo, swimming through the darkness, find a woman unconscious, shocked into insensibility by animal electricity from the outsiders who were invading the city. Nemo comes to grips with someone and finds it to be his old enemy Og. The Marinoids disperse the enemy and the streets were relighted. Nemo returns to his home to find that Nona is gone.

The entrance to the Water of Wild Things, an unknown stretch of sea, is carefully guarded as it is from this point that the invaders have come. An expedition is organized and led by Atar, the king's son, and they go into the Water of Wild Things. Atar, Nemo and Caan penetrate a barrier of vegetation, descend the side of a perpendicular cliff and soon see lights in some sort of a dwelling place. They enter the place and find it to be crowded with other people. Og is seen talking to them and on a raised platform is Nona.

Og declares his love for Nona to the people and says that he will lead them to victory over the Marinoids and that Nona will be their Queen. One of Og's lovers becomes jealous and protests. She is waved away and suddenly returns with a dagger to kill Nona. Nemo interferes and releases Nona. They start away from the Water of Wild Things which is peopled by the Maagogs. They are attacked by these people and captured. Freedom is offered to them if Nona will promise to become their Queen. Otherwise the men would be killed. While waiting for Nemo's decision, Og dramatically causes several children to be executed. At this time he leaves the men who form the expedition from Rax to further consider their decision, warning them that no matter what they decide, Nona would become his Queen.

Atar again led, us in single file. I was last, swimming just after Nona. I turned to look downward. The squid was flashing the water in desperate fury. The fishes, many of them, were floating downward—inert. But many others, ignoring Og's commands in their lust for blood, were still attacking.

WHAT were we to do? With such a choice, what could we say? Soon Og would return for his answer. The water of the cave still seemed ringing with his grim, sardonic voice.

Hopelessly we sat down for discussion. Nona sat on one of the seats where but a few moments before a Maagog mother had dropped and yielded up her infant to the boiling torrent beyond the grating. I shuddered and pulled Nona away. On the floor near the center of the cave, we gathered in a huddled group. I braced my feet in the mud for the current pressed us toward that ghastly grating, beyond which lay death.

The cave was silent save for the sinister hiss of steam beneath it. In the lurid green glow of the lamp overhead our faces were livid, death-like. Death hung all about us. An unseen, imponderable spectre. it seemed to lurk in the very water we breathed.

We were alone—yet not alone either. At the tunnel-mouth those squat black fishes circled back and forth on guard. Occasionally two or three would enter the cave. Poised before us, their eyes seemed gauging us. Uncanny eyes! Eyes almost like those of an intelligent dog whose master has set him

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guard an enemy and who is watching suspiciously, expectantly, that enemy's every move. We lowered our voices subconsciously, as though fearing that the black fishes would hear us and understand.

At first we had little to say. It was all so hopeless. We could not allow Og to return us to Rax and yield up Nona to him. That was unthinkable. And yet, if we did not—The memory of those infants' bodies as they slid downward into the boiling torrent made us shudder with a fear that is implanted deep in every human heart.

Cowards? I do not think you could call us that. But the man who tells you he has faced death—in a calm moment of physical inactivity—without fear, is a liar.

We were all of us afraid, numbed, confused. Abruptly Atar laughed. But his laugh was hollow.

"We must plan something," he said. "We sit here like terrified children."

It was Caan who outlined the situation for us. "Og," he said, "undoubtedly wanted us to accept freedom. He could easily kill us now and keep Nona; but he wanted Nona's promise to be his willing, smiling queen. None other would the Maagogs have."

We could, therefore, count upon Og's returning us three men to Rax, if that were our choice. But could we? It was I who voiced the question. Caan had suggested that possibly we could get to Rax and return at once with others to help us rescue Nona.

"How do we know that Og will not betray us at the last moment?" I demanded. "How easily can he take us to the entrance to Marinoid waters, and there murder us! Returning here, he would tell Nona we were safe in Rax, and hold her to her promise."

It was thus, doubtless, the crafty Og was planning. He wanted Nona's promise—and yet certainly he would not want us three men back in Rax, with our knowledge of the Maagog plans, and of the coming war.

NONA SUGGESTS A PLAN OF ESCAPE

Then Nona herself suggested a possible way out of our desperate situation.

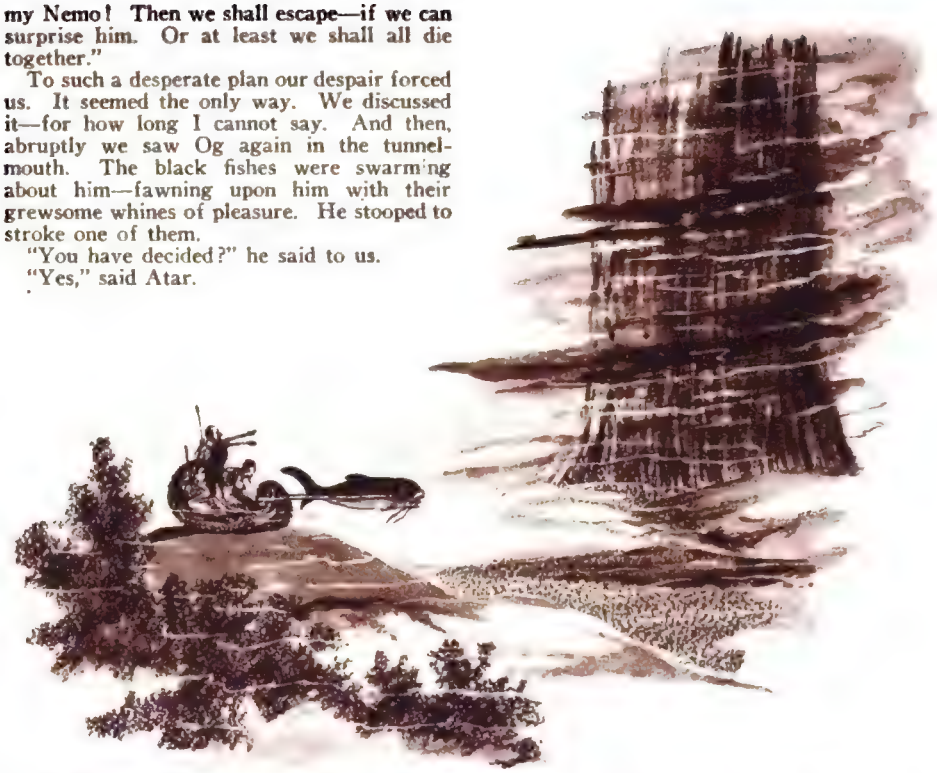
"I shall tell Og," she cried, "that we cannot be sure he will live up to his promise. If he returns you to Rax, I will agree to be his queen. His smiling queen." She shuddered, and her body pressed against mine. "I shall tell him that. And, Nemo, do you not understand? I shall tell him he must take me also to the Marinoid entrance so that I may see you three swim safely into Marinoid waters. He will do that, no doubt. And there—at the last moment—you will fight—we will all fight."

Her white face turned to me; her beautiful lips were pressed grimly together. "Fight, my Nemo! Then we shall escape—if we can surprise him. Or at least we shall all die together."

To such a desperate plan our despair forced us. It seemed the only way. We discussed it—for how long I cannot say. And then, abruptly we saw Og again in the tunnel-mouth. The black fishes were swarming about him—fawning upon him with their grewsome whines of pleasure. He stooped to stroke one of them.

"You have decided?" he said to us.

"Yes," said Atar.



We three—the king, Atar and I—hastened in our sleigh to Gahna. It was more than a revolt! A massacre! The waters of Gahna were running red! The sea there for miles around was tinted rose. The light inherent to the water caught the rose-tint—reflected it with a myriad gradations of beautiful color.

Fear seemed to have dropped from our young prince. For the first time since we left Rax, he dominated Caan and me. He stood now fronting Og unflinching—his face white and set, his eyes smouldering.

But his lips were smiling. "We do not desire death," he said. "We will return to Rax, and she will give the promise you ask."

He turned to Nona, signing her to speak. "You will trust him to send us safely to Rax?" he added.

"No!" cried Nona. And she added, with a flow of woman's words, the proposal we had planned—her insistence that she be taken along to see us safely into Marinoid waters.

Og listened silently. Then he gazed from one to the other of us. The crafty smile on his face made my heart sink.

"You think perhaps to escape with her on the journey?" he suggested. And when we did not answer, his arm waved away the idea. "I shall take care that you do not." Then to Nona: "You speak well, my queen. For your promise I will do much. You shall go."

Again he was silent, pondering. I could almost see some new murderous scheme taking form in his brain. He added suddenly:

"Of course, you shall go, Queen of the Maagogs, if that is your wish."

He turned toward the tunnel-mouth. The black fishes were crowded there, staring at us. Og's sardonic laugh rang out.

"Patience, little black ones. You will go with us, of course. You will go to see that my queen does not escape me!"

He swung back to Atar, and said curtly: "During the next sleep time we will start. The Maagogs—some of them—think I ought to kill you now—not send you back to Rax. We will leave while they are asleep—to avoid trouble. I shall come for you then."

He bowed ironically to Nona, swam to the tunnel-mouth, and with a parting admonition to the fishes gathered there, he disappeared.

Again we were alone. Our plans already had miscarried. We realized it. As though our thoughts had been written on our faces, Og had understood our purpose. There would be no chance for us to escape with Nona. The black fishes were going with us. And during that coming journey, we knew Og intended to kill us men—kill us and still make Nona think we were safe—hold her to her promise.

Time passed. The warm water of the cave oppressed us—yet we were all cold with fear and despair. The very silence of the room seemed sinister—that tense silence that urges one to scream. We were not talking now—we were thinking—planning a thousand desperate, impractical plans, all of which seemed to mean nothing but death for us men, and worse than death for Nona. It must be now the Time of Sleep . . . Og would be back soon . . . I held my Nona close—waiting. . .

A MYSTERIOUS FIGURE APPEARS

In the tunnel a dim human figure appeared, taking shape out of the distant blackness of the passageway. It was swimming swiftly but silently toward us. Through the moving ranks of the black fishes circling there, it threaded its way.

But it was not Og! And then we saw it was a woman—a Maagog woman—Maaret, the girl!

(Continued on page 200)

The sleigh itself was constructed to be slightly heavier than water, so that it could glide along the sea-bottom. But now it was buoyed by tiny air-pods fastened to it, so that of itself it would neither float nor sink. We started away after no more than the briefest of greetings with our king. We three men clung to the rim of the sleigh behind. Its rapid motion threw our bodies out horizontally, like men clinging to the tail of a speeding aeroplane

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Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

No. 29—AROUND THE WORLD IN EIGHTYHOURS

Everything being in readiness, Doctor Hackensaw, through his interpreter, informed the natives that he was under the special protection of their god, Buddha, and that Buddha himself would confirm this. Buddha's commands were uttered through the loud speaker, and a hush of awe fell over the hundreds of spectators.

PROLOGUE

"YES, Mr. Sharp, I'll guarantee these new airplanes of mine to make an average speed of over three hundred miles per hour, and to run more than ten hours without need of making a stop."

The speaker was Doctor Hackensaw, and the person addressed was a blasé-looking young man, whose high position in the government must have been due to strong political pull, as the man was evidently utterly unfit for the position he occupied. Here was Doctor Hackensaw offering to construct for the government a number of aircraft possessing a speed far greater than that of any machines hitherto constructed, and yet this self-satisfied young fellow was refusing to listen to the proposal.

Finally the worthy doctor lost his temper. "Don't you realize, man," said he, "that what I am offering you is an opportunity to make our country the greatest military power in the world?"

"I understand your offer all right," returned the young man, laughing. "But I strongly doubt your ability to deliver the goods. In other words, I don't believe your machine will do what you claim for it, and the country has no money to throw away on experiments."

"If that's all," cried Doctor Hackensaw, eagerly, "I'll give you any demonstration you want, and prove to you that my new airplanes will make three hundred miles an hour or more."

"Yes," returned the young fellow, grinning, "perhaps they will for a few seconds or a few minutes, with the machine a complete wreck at the end of the experiment."

"No, indeed!" retorted the doctor, warmly. "But tell me plainly. What test would you require? I'll agree to any test you ask."

"All right," replied the young man, his grin growing broader. "You say your machine will travel three hundred miles per hour. The distance around the earth is about twenty-five thousand miles, hence your machine ought to make the trip in eighty hours. When you have made the tour of the world in eighty hours, I'll agree to order five hundred of the machines for the government. The only stipulation I make is that you make the experiment within the next hundred years or so, as I am afraid I may not be on the job longer than that." And the young fellow guffawed at his own wit.

"Very well, Mr. Sharp," replied Doctor Hackensaw, quickly, I will accept your conditions, and instead of asking you a hundred years, I will agree to make the trip in a fortnight. I am not too old yet to vie with Jules Verne's Phineas Fogg and to accomplish in eighty hours what took him eighty days, and what took Nellie Bly almost as long!"

CHAPTER I

"Doctor, what's this I hear?" cried Pep Perkins, bursting into Doctor Hackensaw's sanctum, unannounced, as was her wont. Is it true that you're going to make a trip all around the world in three days?"

(Author's Note. When Jules Verne wrote his "Tour of the World in Eighty Days," the feat was impossible. Progress has been so rapid, however, that, unless this story is published at once, the journey around the world in eighty hours may be an accomplished fact before the story appears. As regards the special phonograph mentioned in the story, it should not be more difficult to make a phonographic record that will produce sounds unlike any known on earth, than it is for an artist to draw a picture of things that never existed.)

"A little more than three days," corrected the doctor; "in eighty hours, to be more exact."

"Gee! That will be dandy! Take me along with you, Doc.; I'm just dying for some sort of excitement, and a trip around the world like that, will bring all the shutter-shooters around me, just as they follow Charlie Chaplin and Mary Pickford around."

"I'm sorry Pep, but I can't take you along," replied the doctor; but the young girl, well aware of her power over the worthy man, pretended not to hear the refusal. "How many places will we stop at, on the way?" she asked.

"I shall try to make only seven stops, or eight if you count our landing here in New York on the return—I shall try to arrange to stop every three thousand miles or so. I expect my first stop to be in Paris, the next possibly in Cairo, the third in India, the fourth in Western China, the Fifth in Japan, the sixth in Hawaii, the seventh in San Francisco and the last back here in 'lil ole New York.' Of course, in each place, I shall only stop long enough to get a fresh machine with supplies, for there will be no time to lose. Moreover, to guard against accidents and emergencies, I shall have extra machines waiting for me every five hundred miles of the course, even on the ocean, where the machines will be waiting for me on board ships whose exact location I can ascertain by wireless.

UNKNOWN SOUNDS

"What's that funny phonograph you're working on, now?" asked Pep. "Has that got anything to do with the trip?"

"No, nothing whatever," replied the doctor, little dreaming the service the phonograph was destined to render him. "This is just a new invention of mine. I am making some experiments at present with artificial phonograph records."

"What do you mean by artificial records?" asked Pep.

"Well, you see, an ordinary phonograph reproduces real sounds. My new phonograph produces sounds that have not been made and that never existed."

"How do you manage it?"

"Simply enough. An artist draws pictures of things that exist only in his own imagination. I do the same thing for sounds.

"Cut out the josh, doctor, and tell me straight. I don't understand what you mean."

"All right, Pep. You know, of course that when you speak into a phonograph in making a record, the needle, or stylus as it is called, cuts a groove into the wax. It is the shape and size of this groove that regulates the sounds that the phonograph afterwards reproduces. Now, it struck me that it would be possible to make phonographic records by merely cutting the proper grooves, without having to make the sounds."

"What would be the use of that, even if you could do it?" asked the young lady, taking the chewing gum out of her mouth and fastening it beneath the seat of her chair.

"It would have a great number of uses," replied the doctor. "To begin with, it would enable us to repair records. Many remarkable records by famous persons are spoiled in the taking by some slight accident, and

are worthless. A slight repair to the injured portion would give us many wonderful records. My invention will also enable me to produce records that could not possibly be obtained otherwise. For example, the best soprano cannot sing above a certain key. I can, however, cut records that will produce clear musical notes octaves above any yet sung."

"But the grooves on a phonograph record are so small!" objected Pep.

MECHANICS OF IT

"True. There were certainly mechanical difficulties, but I have solved most of them. In order to cut accurate grooves all that was necessary was to cut them on a large scale, and then reduce them. Of course, I had first to take an ordinary record, magnify it to many times its original size and get an expert engraver to copy the enlarged grooves in a hard-rubber block. Then, by means of a reducing pantograph, these enlarged grooves were cut into a wax disk at the original size and this engraved record made a very good copy of the original.

"I soon realized, however, that I must find a mechanical means for making the enlargement as well as the reduction, and I found the pantograph would serve the same purpose. To the short arm of the pantograph I attached a reproducer and to the long arm a recorder. When the reproducer needle traveled in the grooves of the original record, the recording needle cut grooves, many times the size, on an immense wax disk.

"Before this I had tried enlarging the grooves by using a loud speaker, but I soon found that the depth of a groove made by a loud noise, is very little more than that of one made by a low sound.

"The next step, of course, was to engrave a large record without any model. To obtain satisfactory results, it was necessary to analyze ordinary records in order to discover what connection existed between the grooves and the sounds produced. To do this, I hired a man with very clear articulation to make an ordinary phonograph record of every vowel and consonant sound in the language. I enlarged these records and thus found what shape of groove would produce each letter. My engraver could then produce any sentence I desired by combining the grooves in the proper order to make the sounds. I studied pitch in the same way. A record would be made of a couple of octaves either sung or played on a musical instrument, and a study of the enlarged record showed me what modifications in the shape of the groove produced pitch. Similar studies were necessary to obtain the proper quality and overtones. My first results were promising, but very crude. It was only when I used chemical engraving instead of mechanical engraving that I obtained real satisfaction.

He telephoned the order to the three pilots, the machines started upwards and very quickly reached an unprecedented height of ten miles. For an hour they continued thus, with a speed that exceeded four hundred miles per hour.

"Chemical engraving?"

"Yes. What are called photoplates. For example, to reduce my large engravings to the proper size, I photograph them on a metal disk coated with sensitized film. On developing, the parts which receive the high lights retain the thinnest coating, and when etched with acid produce the deepest grooves. In other words my *negative* is reversed, and if played on the phonograph would give sounds utterly unlike the original. It is therefore necessary to make a *positive* by repeating the process from the negative. The grooves, thus reversed back again, will now produce the proper sound. I am now able to make records that will produce any imaginable or unimaginable sounds. When I want a thunderstorm or a roar of artillery I don't have to wait for Nature or man to supply me. My engraver cuts the grooves we have found will give the proper sounds, and the process is quiet and easy.

"But I'm wasting time. If you're bound on coming with me, I suppose you'll come, but you've only got two weeks to get ready in—only two weeks to collect a supply of face-powder sufficient for the eighty hour trip!"

Pep laughed and began at once to pack up, and not content with face-powder, she prepared a whole trunkful of evening dresses in order to be ready for any emergency. As she remarked: "You never know what will happen when you travel with Doctor Hackensaw. He's a philosopher, and a philosopher is a man who can take care of the whole world, but can't be trusted to look after his own collar-buttons.

CHAPTER II

"Well, Pep, are you all ready?"

"Yes, I'm ready."

"Then jump on board and we'll start off for our tour around the world. Mr. Sharp, it is now five minutes to ten, and the date is August 15th. We have a fine morning for the start, so I shall leave here at the stroke of ten. If you will kindly sign your name in my book here, I will have your agents at the different stopping places sign too, so that you can know there is no fake but that I have really traveled all around the earth. Otherwise you might imagine I had just flown to the nearest "hootch" station and back again. Well, good-bye; I'll be back for the week-end."

So saying, Doctor Hackensaw followed Pep into the airplane that was waiting for them—the "Hoochie," as it was named, after his little girl.

The Hoochie was a large and very peculiar-looking craft. It looked more like an arrow than it did like an airplane, for its wings were quite narrow for the size of the machine, and in addition to the horizontal wings, there were two vertical ones, one on top and one below, like the fins of a fish, and designed to keep the plane from wobbling in its flight. The machine had eight propellers, two in the rear, two in front, one on each side, and two on top that could serve as helicopters when desired, to hold the machine stationary, for they could be swung through an angle of ninety degrees, from a vertical to a horizontal position. Four engines of five-hundred horsepower each, ran the propellers and could be switched to any or all of the propellers by an ingenious gear-shift worked by pressing electric buttons. The entire tonneau, including the pilot-seat, was enclosed in a glass body protected by an outer-metallic casing. Any portion of the metal casing could be opened at will, thus allowing the passengers to view objects outside, no matter where these happened to be situated. An external platform made repair work handy, and facilitated entering and leaving the car. This was also convenient for observations when the car was hovering over one spot.

The Hoochie was a large and very peculiar looking craft. It looked more like an arrow than it did like an airplane, for its wings were quite narrow for the size of the machine, and in addition to the horizontal wings there were two vertical ones, one on top and one below, like the fins of a fish, and designed to keep the plane from wobbling in its flight.

At the stroke of ten the doctor, snugly ensconsed in the car with his fair companion, gave the signal, and away shot the car, hurled by its projector. Meanwhile the engines had been chugging away but almost noiselessly, as they were provided with silencers. Now, however, the propellers were thrown into gear, and forward darted the machine, climbing diagonally up into the sky.

"What are those two other planes that are following us?" asked Pep, looking out through the glass window, and noticing that two other machines very similar in build, had followed them into the air.

(*Continued on page 212*)

Most Famous Farm

By CHARLES

IN A. D. 79, Vesuvius covered a certain area with twenty-five feet of hot mud, liquified with super-heated steam that was permeated with sulphurous acid gas. The cities of Herculaneum and Pompeii were overwhelmed. A farm house in the Pompeiian suburb, now known as the Villa Rustica of Boscoreale was discovered and unearthed in 1894. That ancient concrete farm house contained the most interesting and complete relics of Augustus Caesar's time. The very interesting perspective view of this famous farm illustrated below by our artist, Mr. Wardell, shows clearly how many rooms of this wine farm were arranged according to the ideas of modern efficiency. The picture of the skeleton at the top of this page is interesting, as in the wine tank indicated by the arrow the excavators found this skeleton of a man with a gold chain twenty-nine inches long, six gold bracelets, six thousand dollars' worth of gold coin, and the handsomest antique silver service so far discovered. The engraved silver bowl shown at the top of the page represents a part of this silver service. The most noticeable rooms in the Villa Rustica constitute the bathing establishment which were the best preserved of any so far found. There were five rooms; the first a boiler room containing the hot water heater, with a boiler made of lead encased partially in cement, connected by a series of pipes and valves that permitted water of any temperature to be delivered to the baths continuously. Heat was generated by charcoal and rosin.

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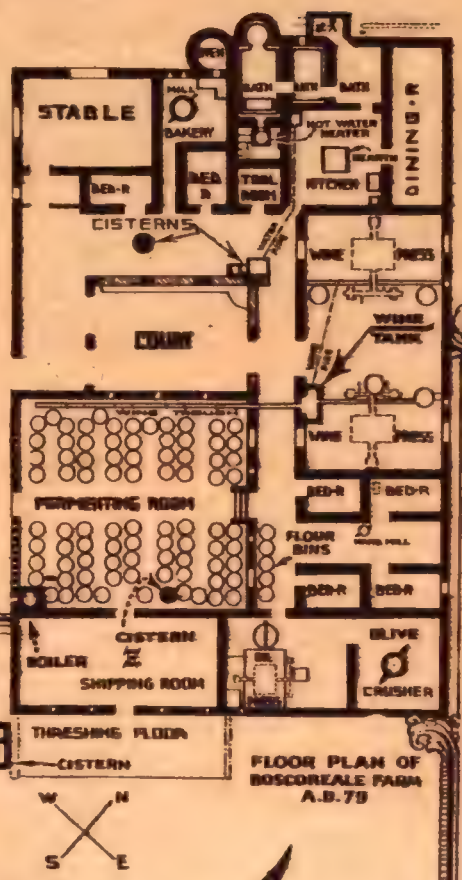
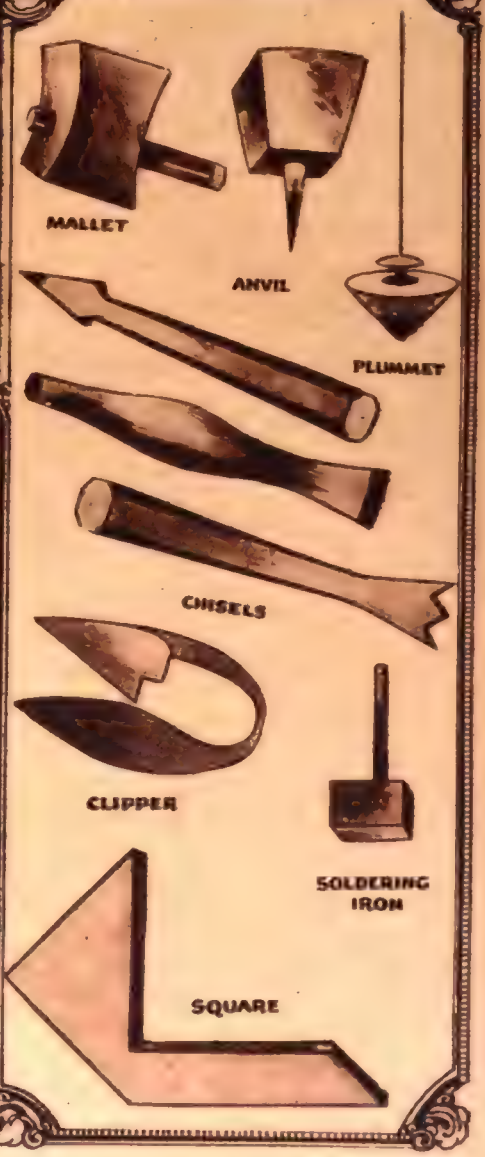
Of All Antiquity

B. BUNNELL

THE floor plan of the Villa Rustica of Boscoreale shown here gives a good idea of the efficient arrangement of this famous wine farm. Continuing our descriptive story from the preceding page, we find next to the bath establishment an interesting bakery, which was equipped with an efficient oven and flour mill. By far the most extensive department was the fermenting room with its eighty-three doliums (earthenware wine containers) that held five thousand gallons of wine in process. It was also provided with a cistern and lead boiler. Romans mixed hot water with wine and the vase used in that capacity was a more costly affair than the average saloon of today. The Frenzy Wine produced a headache that lasted thirty-six hours. The press room housed two wine presses, whose output fell into three round tanks and one rectangular one, which in turn delivered it through a trough to the fermenting room, where it was troughed to the designated dolium. The shipping room adjoins the fermenting room, and here the wine was filled into skins, and thence distributed to wine shops in Pompeii. The threshing floor adjoined the fermenting room. Olive oil was made on one press in a room by itself, and the olives were crushed in the olive crusher shown on the opposite page; this device stripped off the skins without cracking the pits. The hand-mill in the room by itself was used to grind spices and pepper. In outline it resembled the flour mill shown on opposite page; in size it was smaller.



FLOOR PLAN OF BOSCOREALE FARM A.D. 79



The tool room of this antique farm boasted of many interesting specimens. Here were found many scythes with teeth, and oxidized remains of tools. Roman tools from Herculaneum and Pompeii now number so many that we have illustrated some representative ones. The Roman plow resembles the plow of today with this exception—their beam was straight while ours is curved. Their guide wheel was fixed—ours is adjustable. The Greek plow used by Romans was different in all respects. It was said to have been invented by the Goddess Demeter, who in attributes resembles Ceres. The tools shown below include a roller of peculiar design and a folding Roman rule.

The illustrations above as well as to the left show some of the clever ideas followed in tool-making over 2,000 years ago. Engraved gems show blacksmiths working with hammers just as is done today; these gems also show drillers at work. Paintings from Pompeii show a saw of the type of that used in New England today. Another gem shows a modern anvil. Weaving with a bobbin, as now employed on numerous sewing machines, is illustrated on a Roman vase. Children rolling a hoop is engraved on gems, and in fact the Romans left us enough illustrations upon all subjects to fill any ordinary library. With the 100,000 objects excavated from Pompeii alone, their lives and their life histories are known with considerable certainty.

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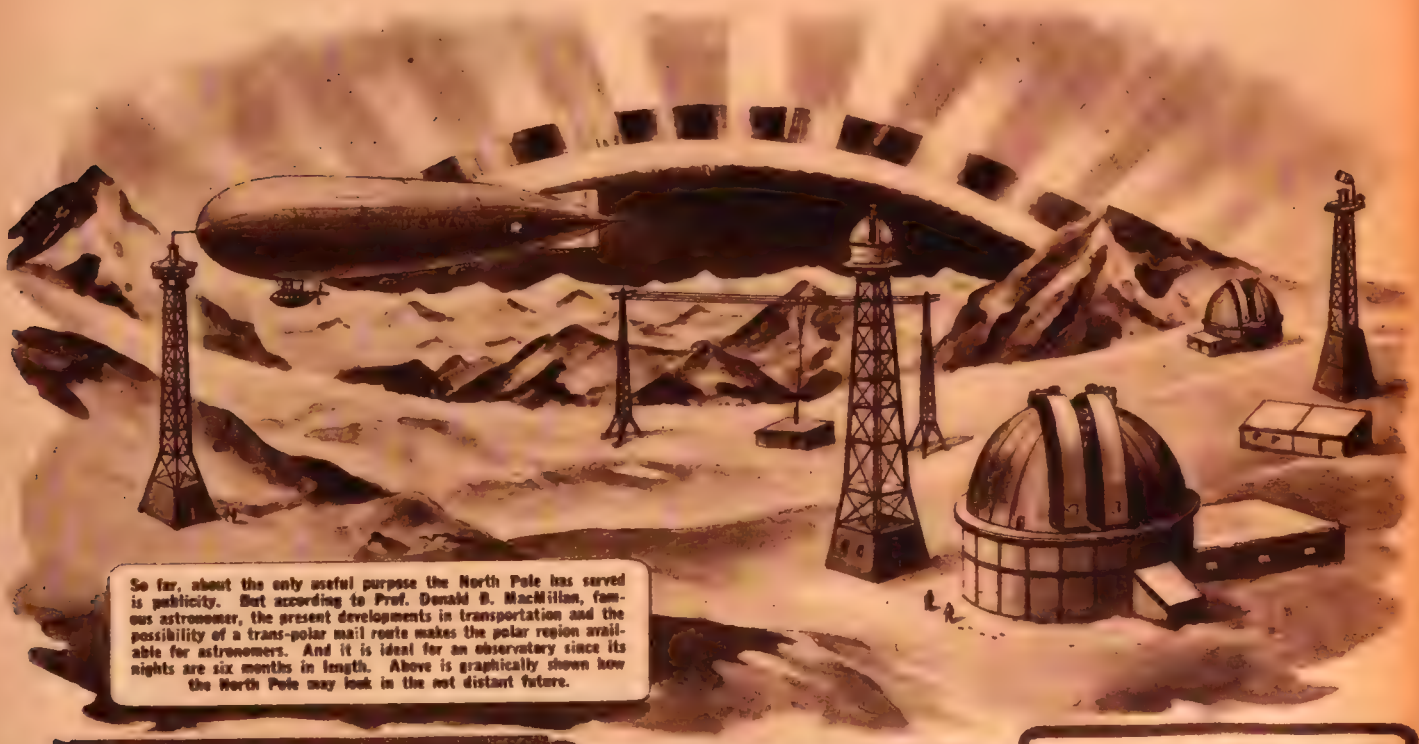
Observatory at North Pole

By CHARLES T. DAHAMA



So far, about the only useful purpose the North Pole has served is publicity. But according to Prof. Donald B. MacMillan, famous astronomer, the present developments in transportation and the possibility of a trans-polar mail route makes the polar region available for astronomers. And it is ideal for an observatory since its nights are six months in length. Above is graphically shown how the North Pole may look in the not distant future.

Although the temperatures at the pole are not extremely rigorous they are nevertheless extreme enough to make out of door observation uncomfortable. This being the case some arrangement would be necessary by which the observer could carry on his work from some kind of shelter. At the left is shown one method that could easily be employed.

One of the most serious difficulties confronting astronomers in the temperate zones is the effect of the sun's rays on oxygen in the atmosphere. The rays change the oxygen into ozone which is practically opaque to the waves at the ultra-violet end of the spectrum. The North Pole observatory will obviate this; the sun will be set for long periods and ozone will disappear shortly after sunset.

At the North Pole all the stars would travel around the earth in circles, never going below the horizon. Observations would never be interrupted by sunrise. Photographic exposures could go on as long as necessary. In the temperate zones after sunset each day the observer is troubled by the continuous rise of heat rays which tend to distort the image formed in telescope. This is a handicap that would be overcome by the observatory. At the right is shown the circular path of stars at the pole.

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The World's Bigness In Figures

Massiveness of Totality

By DR. RUSSELL G. HARRIS,
Harvard University.

THE only method through which the ultra-large figures of the universe may be appreciated is to divide them into multiples familiar to every-day life. Some of these figures are shown here. Interstellar space appears at the top.

By far the most interesting thing in the new physics is the atom with its electrons. These small particles go to make up molecules. If we should tag each of the molecules in a tumbler of sea water we should need more than a million million million million tags (1,000,000,000,000,000,000,000,000). If we should pour the tagged molecules back into the ocean to be mixed thoroughly and then take another glass of water from the ocean anywhere, we should draw out more than 2,000,000 of our tagged molecules.

Some idea as to the number of people on the world and the space they would occupy as standing room is illustrated in the three center illustrations. The amount of the earth, if equally divided, that would fall to each inhabitant is illustrated at the left. There would be enough gold and platinum in each division to make each a millionaire.

The energy of sunlight is depicted below.

AT 267 MILES PER HOUR AIRPLANE JOURNEY WOULD TAKE OVER 10,000,000 YEARS.
NEAREST FIXT STAR 26 TRILLION MILES FROM THE EARTH.
AMOUNT OF EARTH EACH PERSON WOULD GET IF EQUALLY DIVIDED.
5.43 MILES
8 PEOPLE TO EVERY SQUARE MILE IF WORLD'S POPULATION WAS EVENLY DIVIDED OVER LAND AND SEA. PEOPLE ABOUT 600 YARDS (1800 Ft.) APART COULD WAVE TO ONE ANOTHER.
ALL FILLED WITH WORLD'S PEOPLE, 1,610,000,000 LISTENING TO GIANT LOUD SPEAKER WITH 6 MILE RANGE.
ALL OF WORLD'S PEOPLE STANDING IN LINE WOULD EXTEND AROUND EARTH AT EQUATOR 8 TIMES. WORD OF MOUTH MESSAGE WOULD TAKE 50 YEARS TO REACH LAST PERSON.
IN A SINGLE DAY THE EARTH RECEIVES ENOUGH ENERGY FROM SUNLIGHT TO DRIVE 4,000,000,000,000 AUTOMOBILES,— 100,000 TIMES THE TOTAL NUMBER BUILT.
11 MILES LONG
10 MILES WIDE
TIE TAG ON EVERY MOLECULE IN ORDINARY GLASS OF WATER. 1,000,000,000,000,000,000,000,000 TAGS —
MOLECULE
THROW TAGGED MOLECULES INTO SEA AND STIR WELL
TAKE TUMBLER FULL OF WATER OUT OF OCEAN ANYWHERE HOW MANY TAGGED MOLECULES WOULD THERE BE IN IT ?
ENERGY FROM SUNLIGHT COULD LIFT MOUNTAIN WEIGHING 3,500,000,000,000,000 TONS.
1,000 Ft. LIFT

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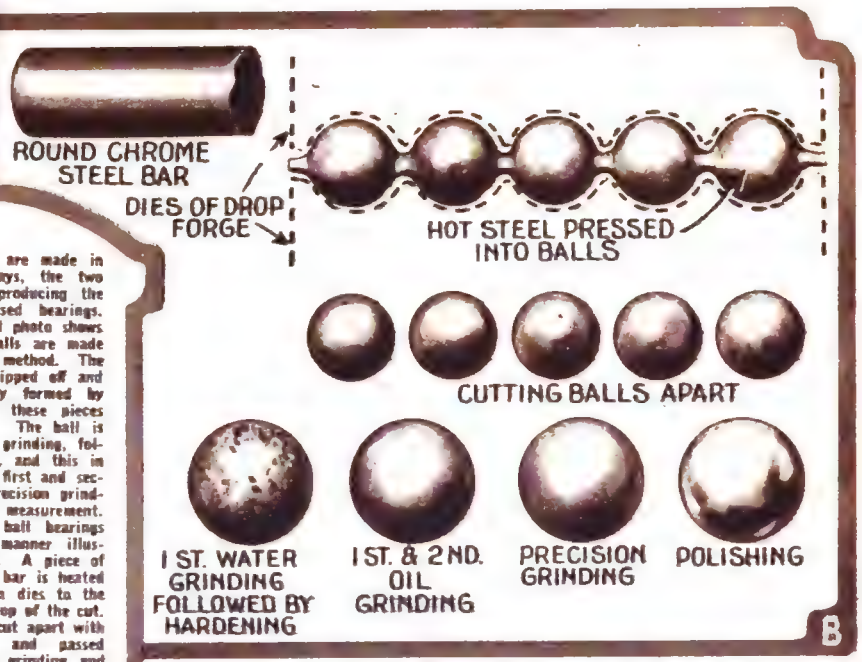
Ball Bearings—How Made

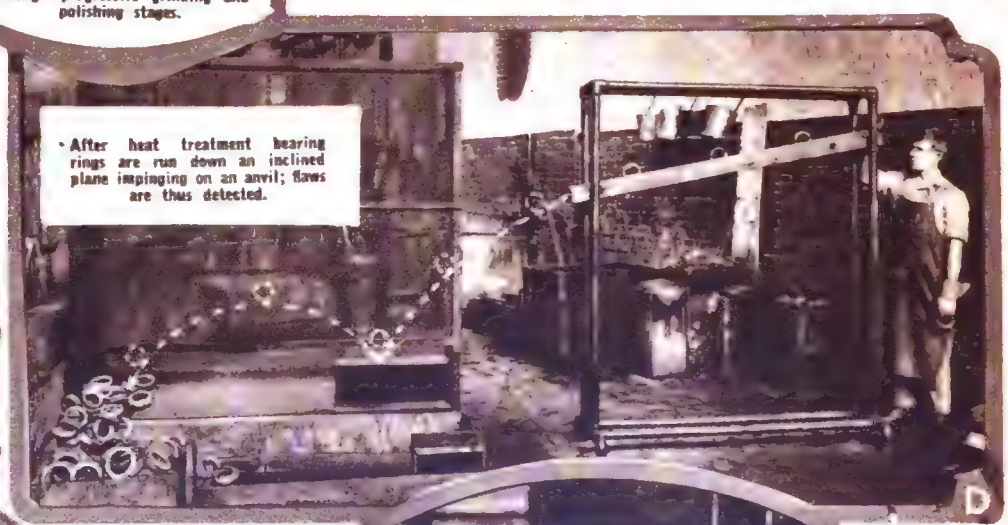
Explaining Various Stages in Ball Bearing Manufacture.

By GEORGE HOLMES

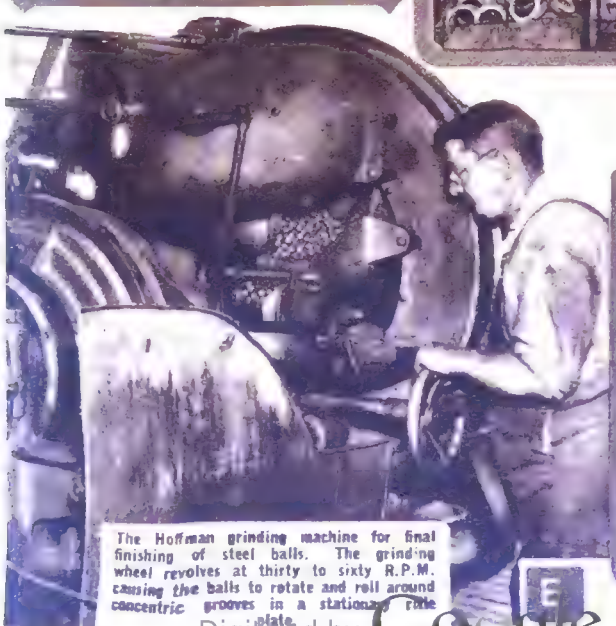


Steel ball bearings are made in several different ways, the two principal methods producing the hot and cold pressed bearings. The upper left hand photo shows how the smaller balls are made by the cold pressed method. The cold steel bar is clipped off and the ball is roughly formed by compressing one of these pieces of clipped off bar. The ball is then given a water grinding, followed by hardening, and this in turn is followed by first and second oil grinding, precision grinding, polishing and measurement. Hot pressed steel ball bearings are made in the manner illustrated at the right. A piece of round chrome steel bar is heated and pressed between dies to the form shown at the top of the cut. The balls are then cut apart with a suitable tool, and passed through progressive grinding and polishing stages.

The photo above shows a remarkable ball bearing measuring gauge, known as the Minimeter. Its whole range is only two one-thousandths of an inch. In any single bearing there is permitted a variation of but 1/2 of 1/10,000 inch.



After heat treatment bearing rings are run down an inclined plane impinging on an anvil; flaws are thus detected.



The Hoffman grinding machine for final finishing of steel balls. The grinding wheel revolves at thirty to sixty R.P.M. causing the balls to rotate and roll around concentric grooves in a stationary cast plate.

Ball bearings are made in sizes as small as a dime, up to 35 inches in diameter, and are designed to operate at speeds of few revolutions per minute, up to 50,000 R.P.M.

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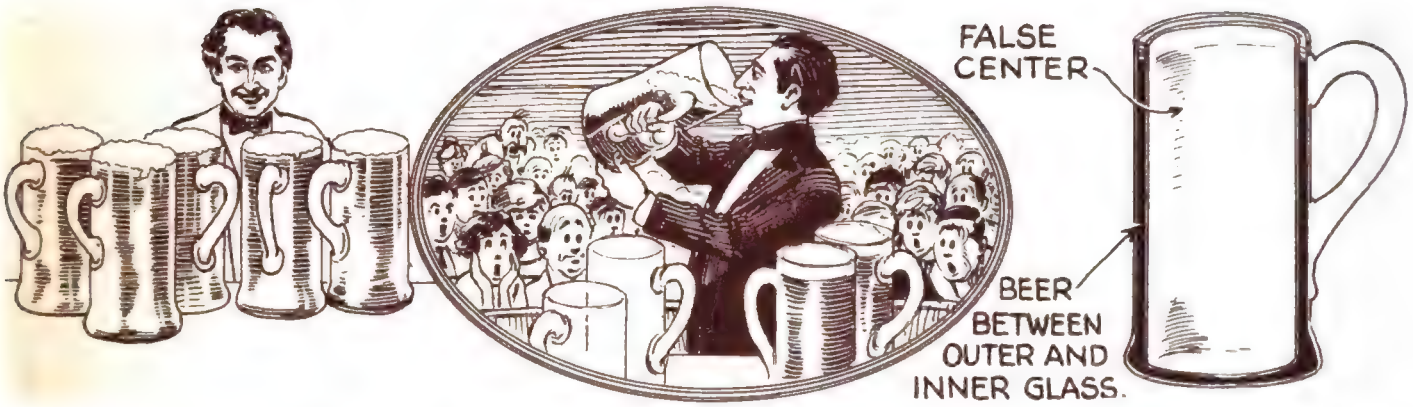
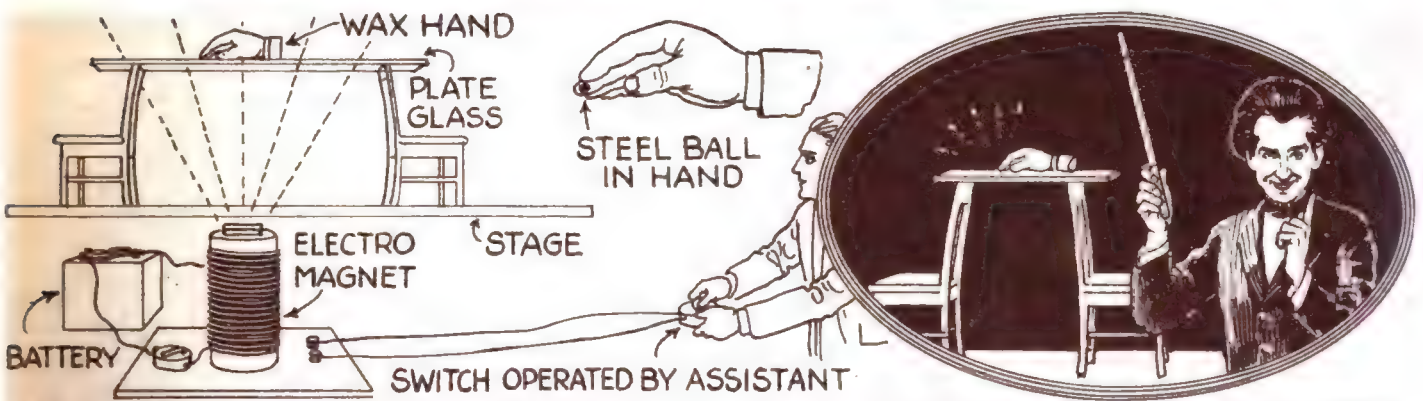
Magic for Everybody

By Prof. JOSEPH DUNNINGER

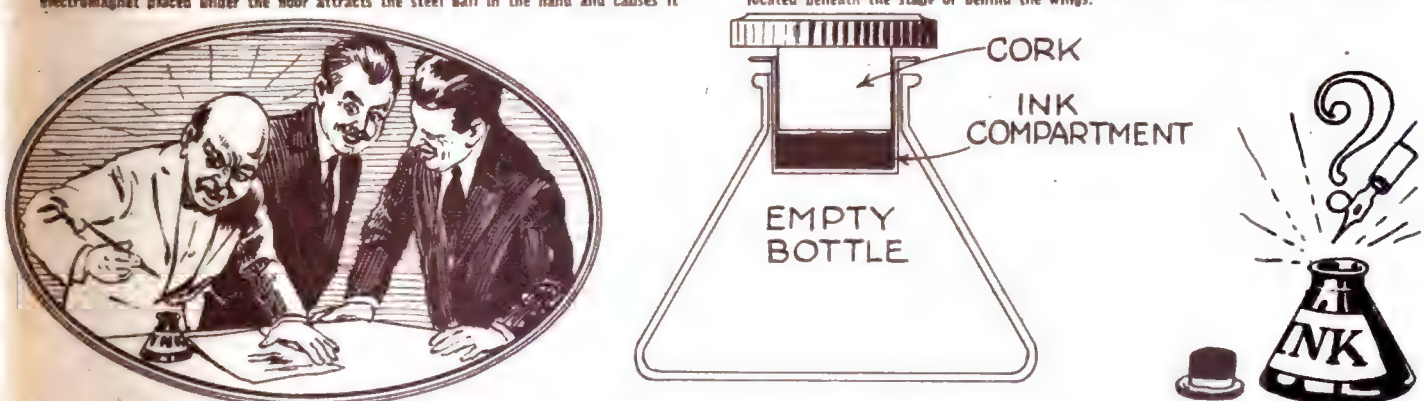
NO. 15 OF A SERIES



The performer, after a rather long speech, tells his audience that prohibition has made him dry and asks for a glass of beer. His kind assistant brings out an immense glass full of the foaming liquid and continues to bring forth glass after glass while the performer downs their contents with remarkable rapidity. The way is shown in the sketch. The glass is double and the liquid fills the space between the two walls, making it appear that an immense quantity has been consumed.



The mystery of the rapping hand is made plain in the above illustration. A large electromagnet placed under the floor attracts the steel ball in the hand and causes it to tip. At each tip a distinct click is heard. The hand is operated by an assistant located beneath the stage or behind the wings.



The performer dips his pen into an ink bottle and writes a short note. He then hands the pen to one of the spectators and requests that the paper be signed. Much to the spectator's surprise, the ink bottle is empty. The secret is a small false ink well which is slipped into the bottle and which is removed with the cork.

An empty glass is held by the performer. With a sudden lunge forward the glass will be found to contain a silk handkerchief. This is removed and the glass again held up for examination. The method by which this trick is performed is to attach to the back of the hand a small metallic box. This may be secured to a finger ring. A thread passes over the top of the glass through a hole in the bottom and is attached to performer's coat. Moving the hand forward produces the illusion.

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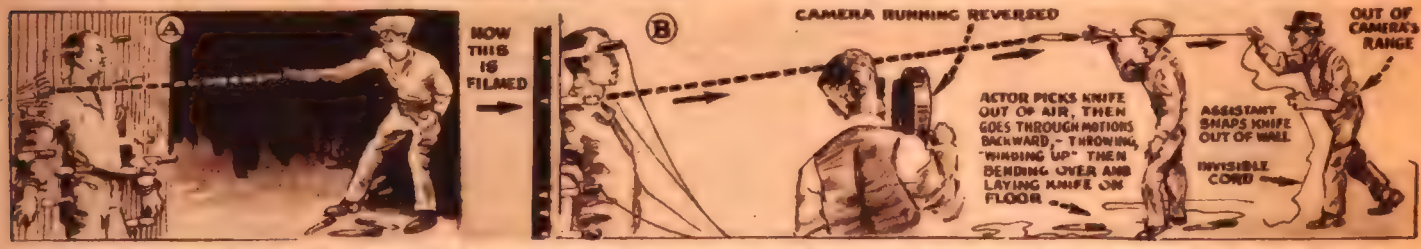
Mystifying Movies

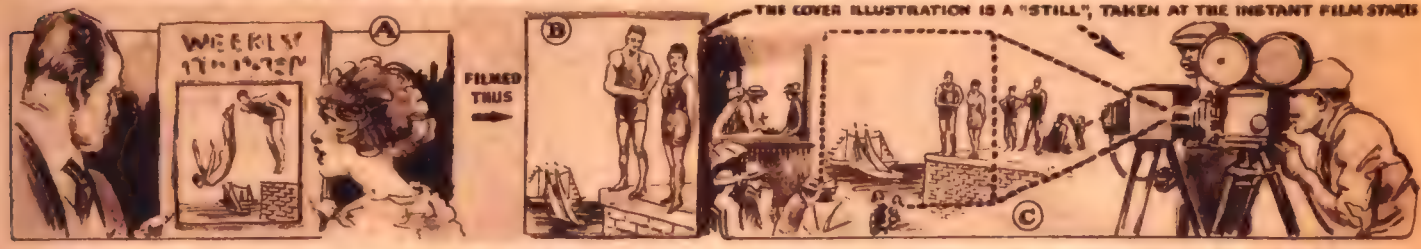
How the Ordinary Film Oddities Are Produced in the Studio.

Although many movie effects are produced in the printing room of a studio, those illustrated on this page, are taken with a view toward eliminating double and trick printing. At A is a scene as it appears when projected upon the screen. The manner in which this is filmed is illustrated at B. A mirror is placed considerably back of a table at an appropriate angle, so that the reflection of a dancer may be seen in the mirror. She will appear dancing on the books on the screen.

Suddenly the lady's reflection disappears and in its place she sees the face of a man. Amazed, she glances at the mirror again, but sees her own reflection. This effect is produced on the negative by gradually dimming out view A. Rewinding the film, the mirror is replaced with a black velvet screen. The actor takes his place in the frame and the camera is again operated, while the picture of the man is faded in and out again to be finally faded in on scene C.


A
HOW THIS IS FILMED
B
CAMERA RUNNING REVERSED
OUT OF CAMERA'S RANGE
ACTOR PICKS KNIFE OUT OF AIR, THEN GOES THROUGH MOTIONS BACKWARD,- THROWING, "WINDING UP" THEN BENDING OVER AND LAYING KNIFE ON FLOOR
ASSISTANT SNAPS KNIFE OUT OF WALL
INVISIBLE CORD

The knife thrower shown in A above is a cracker-jack. He does not even have to aim at his target, but with lightning rapidity and fancy twists he pins his man to the wall. The method by which this film is made is by fixing the man fast with the knives in place. To each knife an invisible cord is secured. The camera is run in a reverse direction. By jerking on the cord, an assistant removes one knife after the other. The thrower's motions naturally are reversed.



Examining a weekly magazine, the picture on the front cover showing a diving scene suddenly becomes animated. This stunt is produced in the following manner. The motion picture operator starts to grind his camera at the same time that the still photographer snaps the picture. When the close-up view of the cover of the weekly periodical is shown, the still photograph occupies the first portion of the projecting time and it is then substituted by the animation.

An automobile tire is started at the top of a hill, and rolls downward. For no reason at all—at least for no seeming reason—it stops in its downward motion and ascends to the top of the hill again to the consternation of the onlookers. The picture is taken of the tire rolling down hill. The tire is first photographed in the regular way rolling down hill. It is then rolled down a second time and photographed with the camera running in reverse.

This is a result of duplex printing on one film. A man starts from [illegible] at his utmost speed from one town to the other covering all the main towns on the face of the globe.

Old travel films may be used in this stunt and Lectures Pour Tous says that the scene with the actors may be produced in the studio where he runs on a treadmill.

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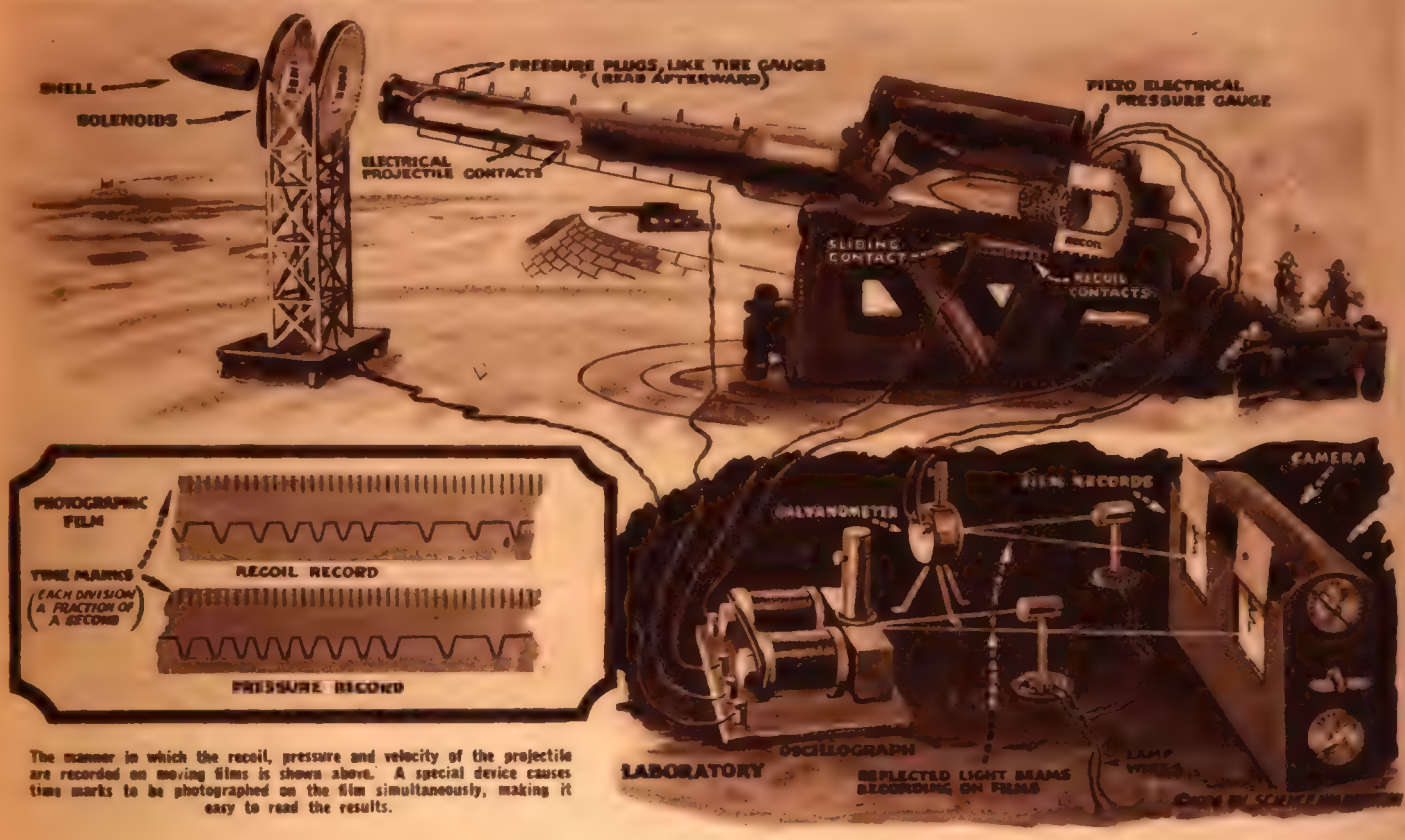
Testing Cannons by Electricity

By RAYMOND FRANCIS YATES



The manner in which the recoil, pressure and velocity of the projectile are recorded on moving films is shown above. A special device causes time marks to be photographed on the film simultaneously, making it easy to read the results.

Big gun experts have always wanted to know just what happened inside a cannon at the very moment of explosion. The apparatus here shown—and perfected at the Aberdeen, Md., proving grounds—accomplishes this work. In the breech of the gun, there is placed a piezo-electric gauge, the shock of explosion causing a static electric charge to be produced in quartz crystals. This electric charge registers on a ballistic galvanometer, and the result is recorded upon a moving photographic film, as shown in the picture. Electrical recording devices register the amount of recoil, and the velocity of the projectile. Individual pressure gauges are inserted along the gun barrel.

Human "Lightning Calculator"

Even with modern adding, subtracting and multiplying machines, the speed of Mr. Sullivan (shown in the pictures herewith, and in two of the views with Professor Joseph Dunninger), cannot be beaten. An illustration of this is given below. Two numbers were given to Mr. Sullivan, that is to say a figure under a hundred was told him. He was to give the square and cube of this number. The complete answer was returned in four and three-quarter seconds from the time the number was mentioned, all calculation done by him being mental.

Eight figures were placed on the slate as shown in the photo below. Mr. Sullivan looked at the figures for two-fifths of a second. He called them back in order from left to right and again reversed from right to left in three and three-fifths seconds. Mr. Sullivan cannot account for his phenomenal speed at figures. He can multiply three numbers by three others mentally, and invariably produce the correct answer. In a test in the freight yards, Mr. Sullivan was able to remember the numbers on twenty cars as they passed him, and was able to call them back and mention each and every road designation.

The figures on the slate above were arbitrarily put down by a spectator. These were held by Mr. Sullivan as shown. The total, however was not on the slate. Lifting up his left hand, so that the figures were upside down, he glanced at them. The duration of the glance was one and three-quarters seconds. Thereupon the total was immediately called back and found to be correct. Do you suppose that you could add a column of figures of this nature after glancing at them for one and three-quarters seconds, even if they were in an upright position?

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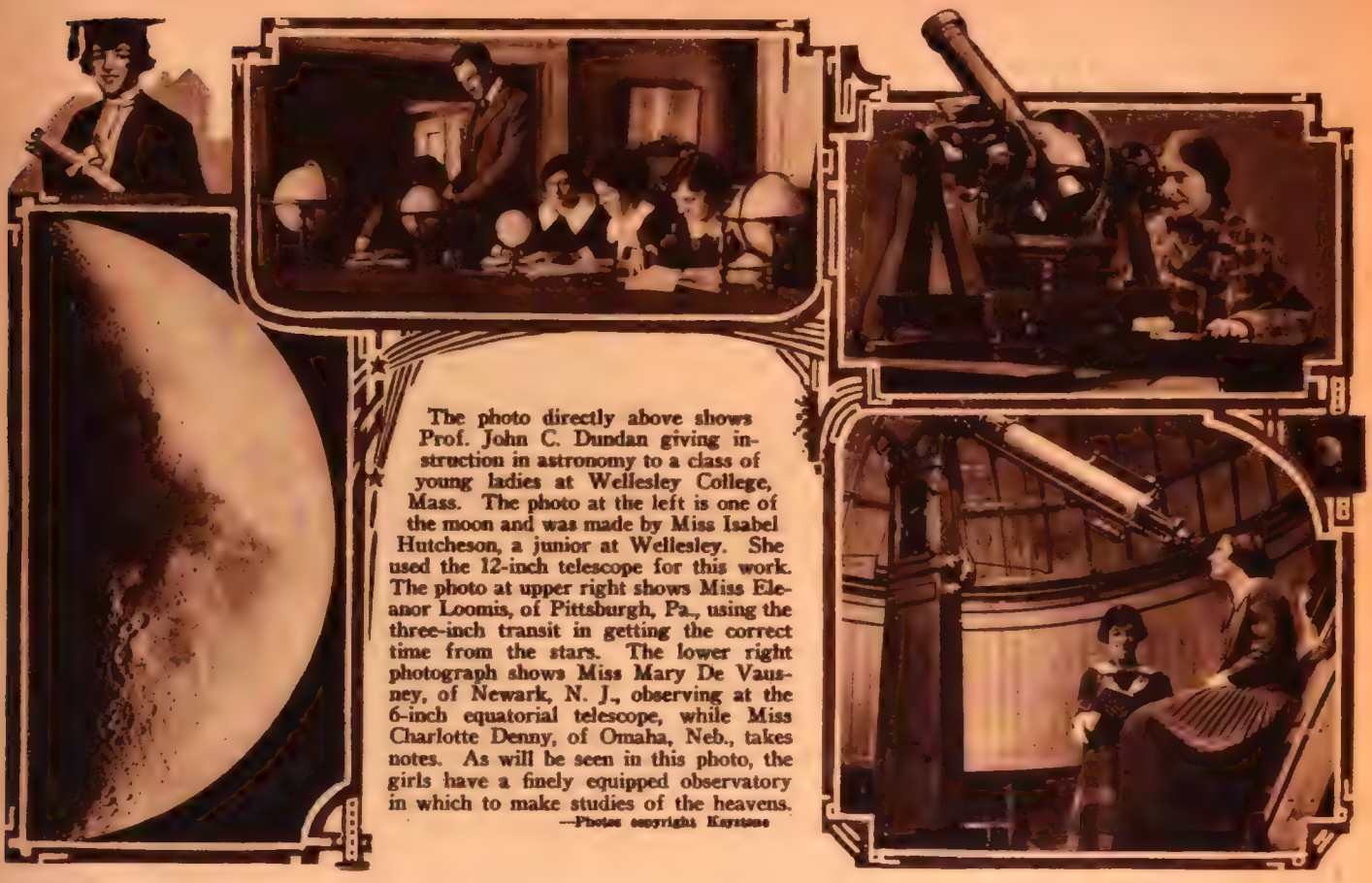
Girls Enjoy Astronomy Studies



The photo directly above shows Prof. John C. Dundan giving instruction in astronomy to a class of young ladies at Wellesley College, Mass. The photo at the left is one of the moon and was made by Miss Isabel Hutcheson, a junior at Wellesley. She used the 12-inch telescope for this work. The photo at upper right shows Miss Eleanor Loomis, of Pittsburgh, Pa., using the three-inch transit in getting the correct time from the stars. The lower right photograph shows Miss Mary De Vausney, of Newark, N. J., observing at the 6-inch equatorial telescope, while Miss Charlotte Denny, of Omaha, Neb., takes notes. As will be seen in this photo, the girls have a finely equipped observatory in which to make studies of the heavens.

—Photos copyright Keystone

How the Obelisks Were Raised

These interested in trying to solve the problem as to how such ancient structures as the Obelisks were raised, will do well to study a new work written by Mr. R. Engelbach, Chief Inspector of Antiquities, in Upper Egypt, who has written a most interesting treatise entitled, "The Problem of the Obelisks." The accompanying pictures illustrate one of the most plausible theories as to how these giant stone monuments were erected. It should be remembered that in many cases these great monuments were placed in position in squares or parks, close to public buildings, which made the problem all the more difficult. The series of pictures looking from left to right at the top of the illustration, show how these giant Obelisks were very probably hauled on rollers upward along an incline or ramp constructed of sand, and then erected in position by removing the sand from over the position of the previously placed stone base, in the manner indicated. As the sand was lowered by removal through the tunnel alongside of the base, the obelisk [illegible]

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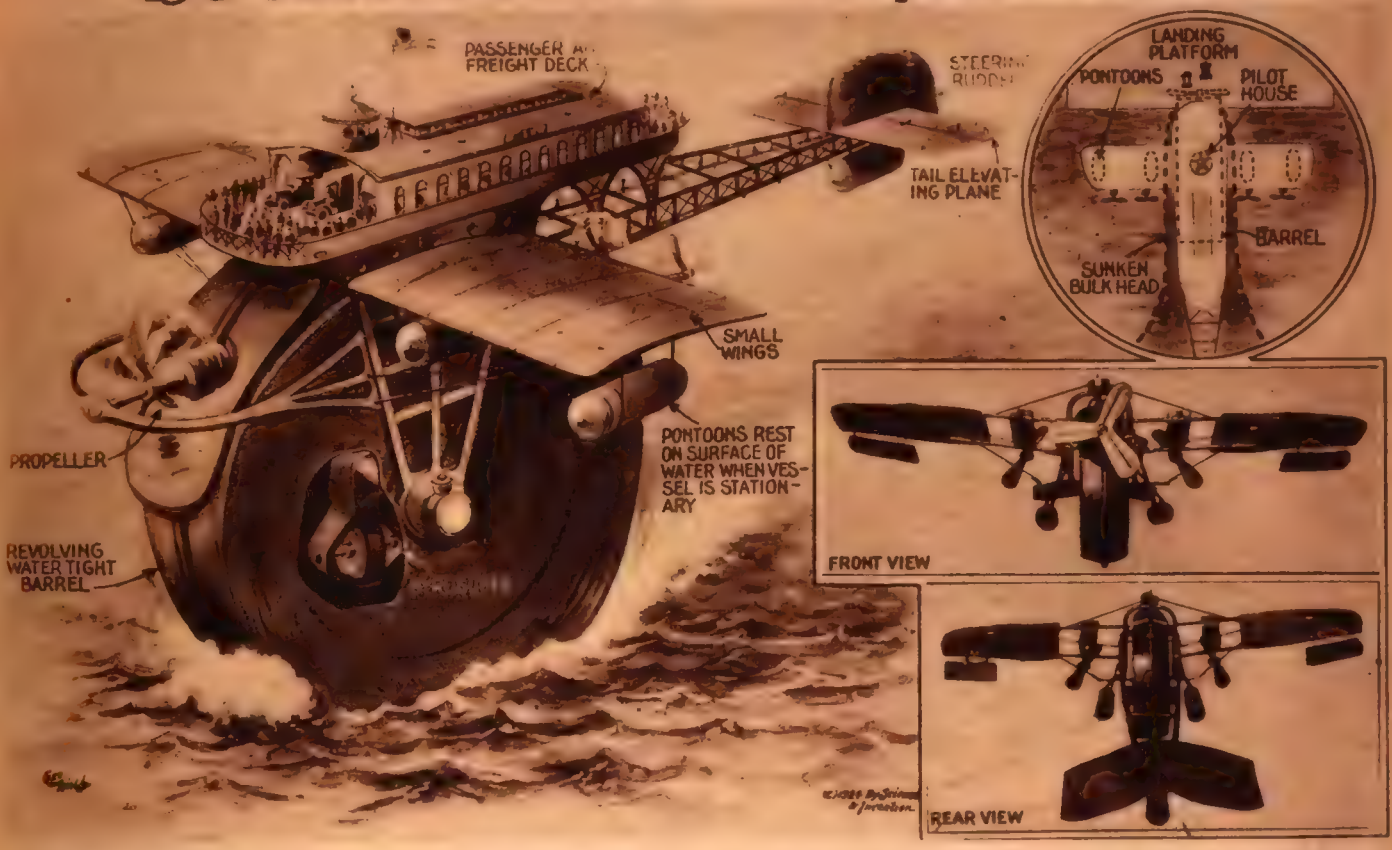
150 Miles Per Hour In Speed Ferry



The new type of ferry boat seen in the illustration above will be able to attain a speed of 150 miles an hour. The circular hull revolves upon the stationary axle. In the hull a gyroscope is mounted to steady the vessel when it is not moving forward. As the speed increases the vessel rises almost completely out of water. When nearly stopped the pontoons rest on the surface of the water, but locomotion is by means of propellers. Photos show model.—T. J. Cox

Increasing Liners' Speed

The inventor of the system illustrated above believes that he can greatly increase the speed of trans-oceanic liners by placing fins on the side of the vessel in the manner shown. These fins have a limited motion either upward or downward. When the currents of the water act upon the fins, they move freely to the limit of the space allowed them, thereafter the energy of the water striking the blades produces a resultant forward motion. —P. Henriksen

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Above is the star map for the month of June. If the chart is held over the head with the "Northern Horizon," north, at nine P. M., June first or eight P. M. June fifteenth the location of stars is seen.

The Heavens in June

By ISABEL M. LEWIS, M.A.

of the U. S. Naval Observatory

IN these early summer evenings the constellations that we will find on or close to the meridian are Virgo, The Maiden, in the south and southwest, to the north of Virgo, Coma Berenices and Boötes, and farther north Draco, The Dragon, and Ursa Major, The Greater Bear.

Virgo has been ever The Maiden or Virgin, generally the goddess of harvest, in classical days Ceres or her daughter Proserpine. The brilliant white star Spica is supposed to represent the wheat-ear that she holds in her hand, symbolic of the harvest. To the Arabs Spica was the solitary or defenseless one, so-called from its solitary position in the heavens far from any other bright star. Aratus, in his astronomical poem, The Phenomena, written in the third century before Christ, saw Astraea, the goddess of Justice and Purity, rather than the goddess of the harvest, the constellation in Virgo. During the golden age she dwelt on earth but as the earth began to degenerate she took up her abode in heaven at the dawn of the silver age, occasionally returning in the evening time to visit those who still cared for her. With the coming of the brazen age of war and violence she left the earth never to return. Virgo is the largest of the zodiacal constellations that lie in the path of the sun, moon and planets. Aside from Spica it contains no star brighter than third magnitude. It can be recognized by its Y shaped configuration of stars to the northwest of Spica which lie at the bottom of the Y. At this time we will also find in Virgo the beautiful planet Saturn, yellowish-white in color, a little to the northeast of Spica. Saturn is nearly twice as brilliant as Spica, though it is not as bright as Vega or Arcturus, now east of the meridian, and is far inferior to Venus now close to the western horizon and to Jupiter rising in the southeast. In Virgo is now located the autumnal equinox, the point of intersection of the equator and ecliptic through which the sun passes at the beginning of fall in September. In classical times this point was in Libra, the next constellation to the east of Virgo, but owing to the "precession of the equinoxes" which is a slow westward shifting of the point of intersection of the two circles the sun is now in Virgo instead of Libra when fall begins.

Within the branches of the Y in Virgo and to the north in Coma Berenices and between this constellation and Denebola is a wonderful region. Here with even a small telescope

(Continued on page 211)

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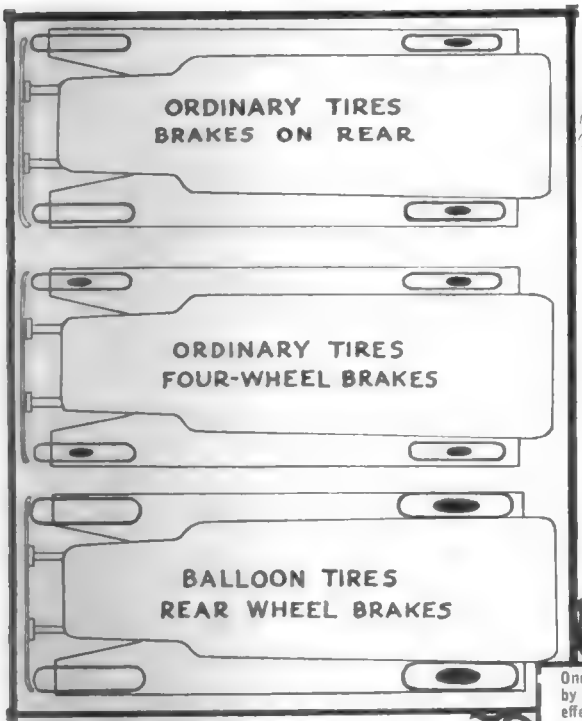
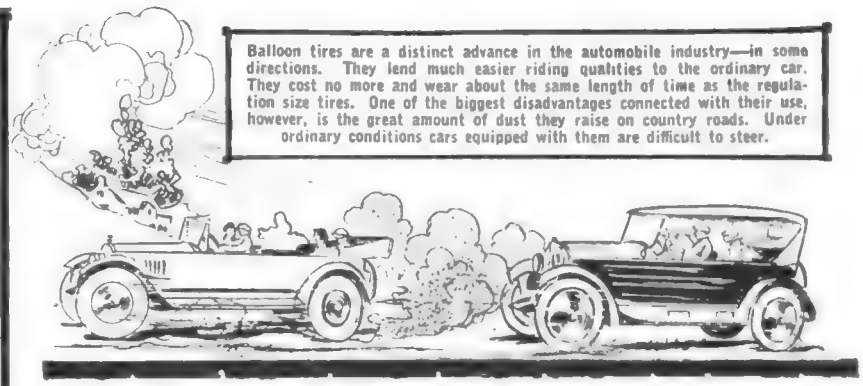
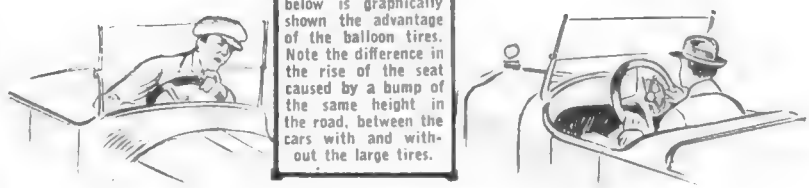
The Truth About Balloon Tires

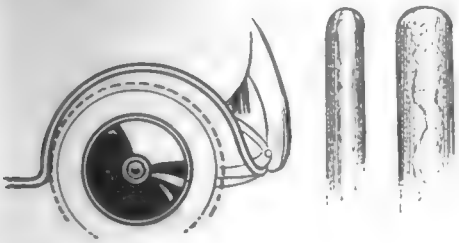


Balloon tires are a distinct advance in the automobile industry—in some directions. They lend much easier riding qualities to the ordinary car. They cost no more and wear about the same length of time as the regulation size tires. One of the biggest disadvantages connected with their use, however, is the great amount of dust they raise on country roads. Under ordinary conditions cars equipped with them are difficult to steer.

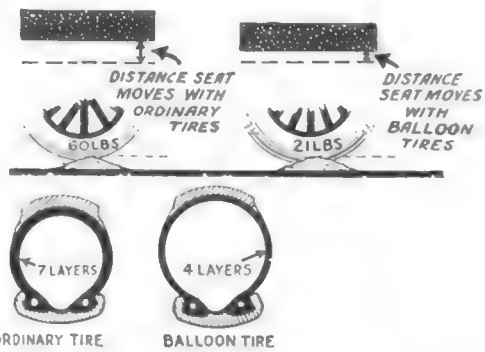


In the small sketch below is graphically shown the advantage of the balloon tires. Note the difference in the rise of the seat caused by a bump of the same height in the road, between the cars with and without the large tires.



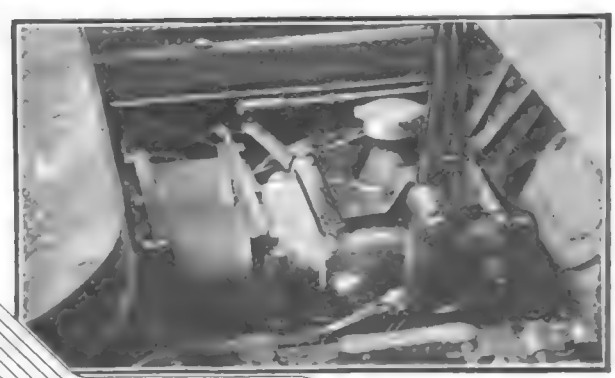


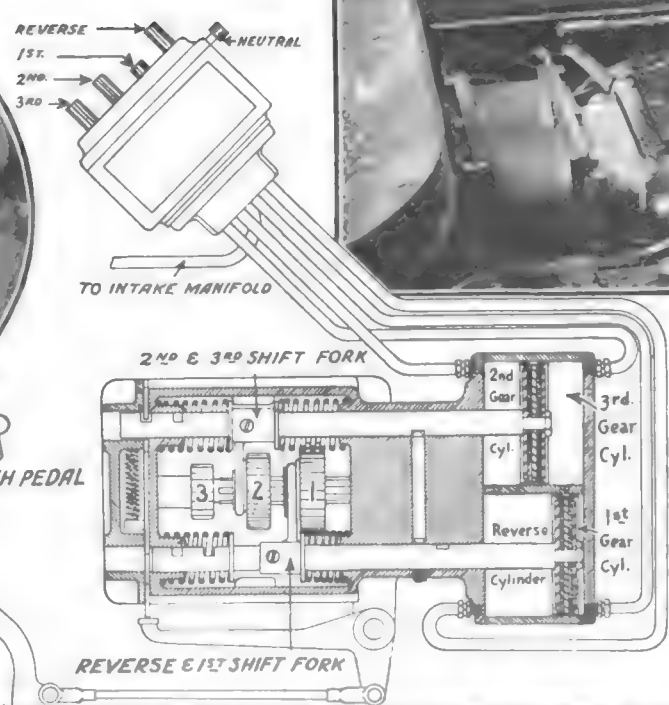
One of the greatest advantages to be gained by the use of this new type tire is the added effective braking area. In the large sketch above to the left is seen the comparison between the braking area of a car equipped with ordinary tires, a car using four wheel brakes and the two wheel brake car using balloon tires. At the right below is shown the reason for their ease of operation and large braking area. Note the increased diameter of the tire and the thin side walls, giving greater flexibility. A distinct disadvantage of the new tire is the fact that unless their inflation is watched very closely, their efficiency drops. Practically every car must have new fenders; also smaller wheels for best results. If the alignment of the wheels is not perfect, the tires will show excessive wear.—W. B. Arvin.



Pneumatic Gear Shift

A gear shift which is worked entirely from a set of buttons on the steering column is the latest refinement in driving. The hand lever is removed and the two cylinders and pistons are placed on the ends of the shifting rods. Power is furnished from the intake manifold or from a vacuum feed device. Selection is made by attaching each of the buttons to a valve which causes the vacuum to be applied to the proper end of the respective cylinder. The shift does not work until the clutch pedal is pressed. —C. G. Percival.





A diagrammatic drawing of the complete apparatus is shown at the center. It is not necessary to change the gear arrangement of a car in order to install this gear shift, since it can be placed directly on the end of present installations. The manufacturers make a model for each type of car. The vacuum appliance and the corresponding size of the pistons and cylinders have been so selected that the operation of the shift does not interfere in any way with the efficiency of the motor. The button arrangement can be placed just below the steering wheel and is made to bolt directly to the steering column.

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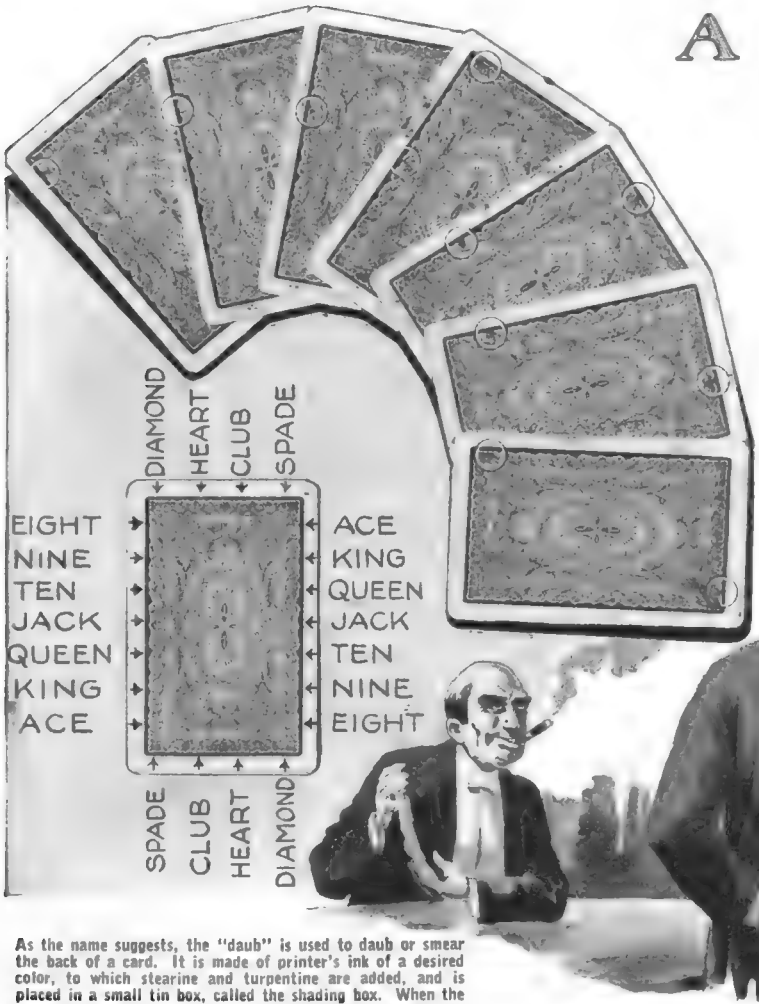
A Gambler's Tricks Exposed

By MARK MELLEN

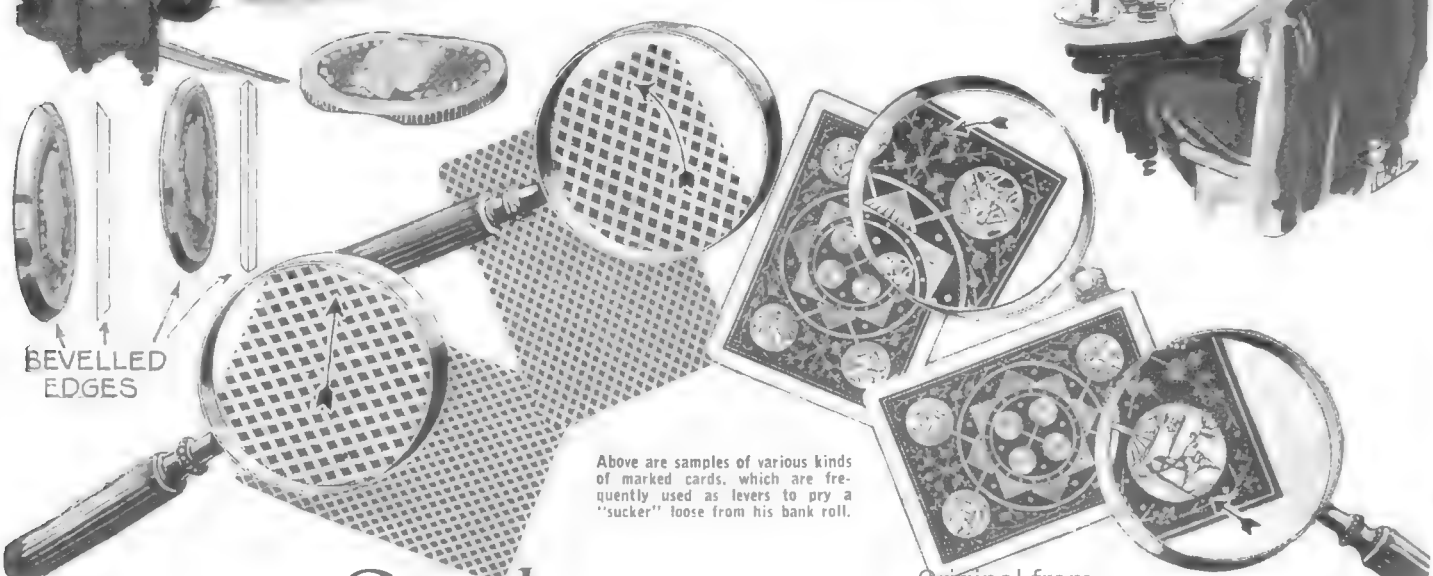
The Man Who Fooled P. T. Barnum

This month on this page will be found several methods of cheating not generally known to those unfamiliar with gambling methods. Do not think for one moment that, even though you use your own deck of cards in a game, those cards cannot be marked. For this purpose the "daub" comes in very handy. The "holdouts" described last month are also frequently employed. Aside from that the professional gambler may use the "check cop" to diminish the pile of checks which the opponent may have, or may use his own marked cards if he can manage to get them into the game. Professionally marked cards, that is, cards which may be purchased already marked, are never employed by a clever crook. Even coins are easily doctored.



As the name suggests, the "daub" is used to daub or smear the back of a card. It is made of printer's ink of a desired color, to which stearine and turpentine are added, and is placed in a small tin box, called the shading box. When the thumb is touched to a slot in the shading box, some of the daub adheres, sufficient to shade the back of a card. The cards are daubed while playing, a mark being made on the upper edge to identify the suits. A mark along either side indicates the value of the card. See illustration above, and notice how faint the daubs in the circles are.

In spinning coins real U. S. coins are often doctored in the manner illustrated herewith. Each coin has a beveled edge as shown, and can fall but one way, always "heads" or always "tails", according to the way in which the edge is beveled. Half dollars are sometimes beveled, so that when spun they can fall either way. The section over the head is beveled in one direction, whereas that below the date is shaved off in the opposite direction. The rest of the coin is untouched. Illustrations show the bevel greatly exaggerated. The "check cop" illustrated at the right is really beeswax. A piece is stuck to the palm of the hand. Then while seemingly pushing the poker chips or coins to the center of the table, or piling them up, the cheater, with palm down, causes the chip or coin to stick to his hand, and is thus enabled to "cop" or steal it. Be suspicious of the person who "monkeys" with the chips. The man who takes "kitty" or "cuts" the game, frequently uses a "check cop." Below are shown several fine examples of gamblers' cards. On the "fan backs", the identifying marks are made by partly obliterating some figure contained in the fan, as a leaf or twig by means of acid. The suits are identified by obliterating a flower petal. The plaid backs have little lines drawn across the white squares, less than 1/16 of an inch square.



Above are samples of various kinds of marked cards, which are frequently used as levers to pry a "sucker" loose from his bank roll.

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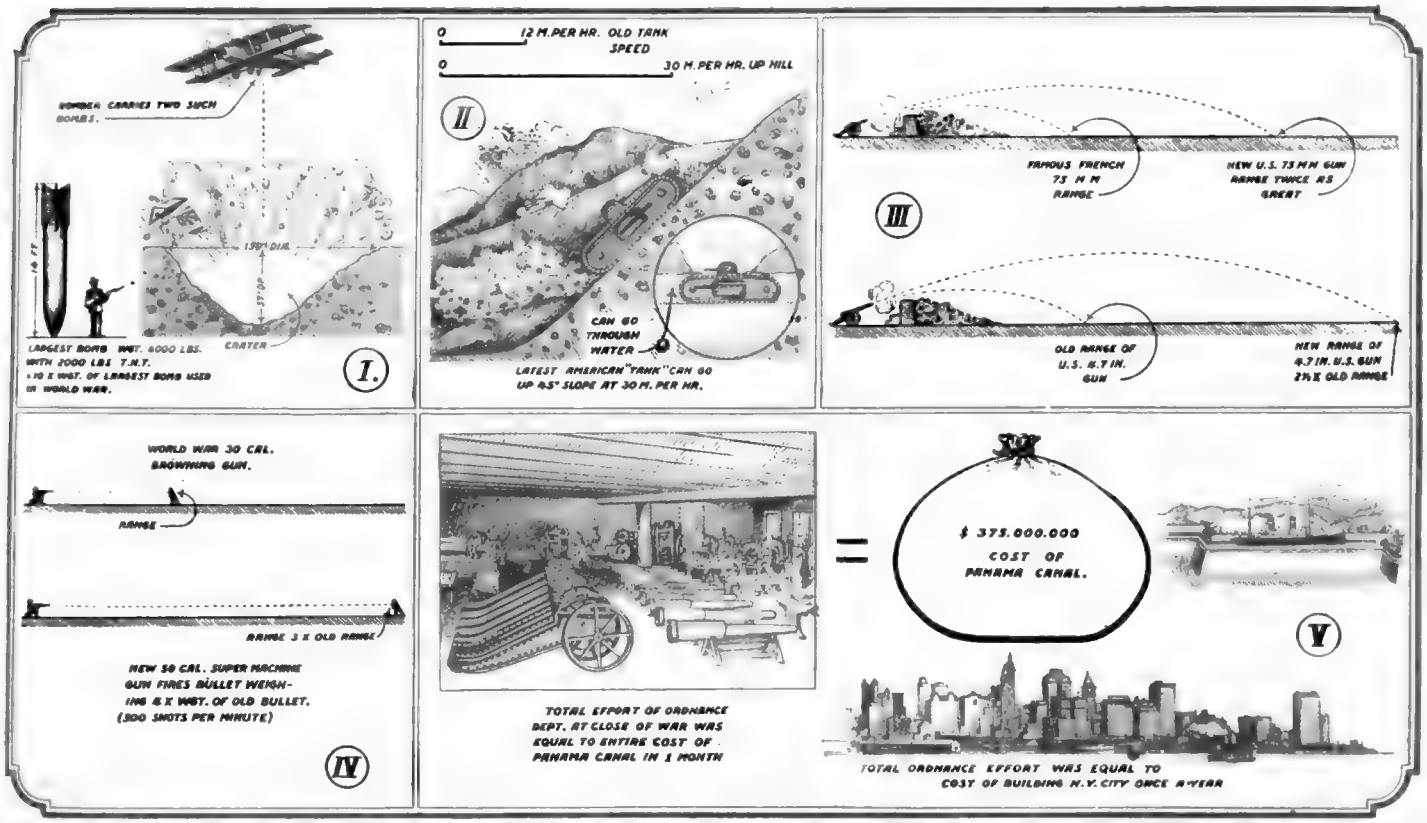
Some New War Machines


BOMBER CARRIES TWO SUCH BOMBS.
18 FT.
150' DIA.
37' DP.
CRATER
LARGEST BOMB WGT. 4000 LBS. WITH 2000 LBS T.N.T.
10 X WGT. OF LARGEST BOMB USED IN WORLD WAR.
I.
0 12 M.PER HR. OLD TANK SPEED
0 30 M.PER HR. UP HILL
II
CAN GO THROUGH WATER
LATEST AMERICAN "TANK" CAN GO UP 45° SLOPE AT 30 M. PER HR.
FAMOUS FRENCH 75 M M RANGE
NEW U.S. 75 M M GUN RANGE TWICE AS GREAT
III
OLD RANGE OF U.S. 4.7 IN. GUN
NEW RANGE OF 4.7 IN. U.S. GUN 2½ X OLD RANGE
WORLD WAR 30 CAL. BROWNING GUN.
RANGE
RANGE 3 X OLD RANGE
NEW 50 CAL. SUPER MACHINE GUN FIRES BULLET WEIGHING 6 X WGT. OF OLD BULLET. (500 SHOTS PER MINUTE)
IV
TOTAL EFFORT OF ORDNANCE DEPT. AT CLOSE OF WAR WAS EQUAL TO ENTIRE COST OF PANAMA CANAL IN 1 MONTH
=
$ 375.000.000 COST OF PANAMA CANAL.
V
TOTAL ORDNANCE EFFORT WAS EQUAL TO COST OF BUILDING N.Y. CITY ONCE A YEAR

Several major developments have been made in the manufacture and design of ordnance since the close of the Great War that promise to make fighting even more deadly in the future than it has been in the past. At 1 is shown a new aerial torpedo that is much larger than any such instrument used during the last war. One of the greatest developments however, is the new tank shown at II capable of greater speed and ease of operation than any of those designed before. At III is shown the comparative range of new American 75 mm. gun that has a greater range than the famous French field piece of the same size. A new machine gun that bids fair to change the future design of such guns has its range indicated at IV. Some idea of the huge cost of the last war (and future ones) may be gained from the figures at V.

Two Peculiar Experiments

At St. Catherine's Hospital, Brooklyn, N. Y., surgeons have found great advantage in performing certain operations with the aid of a phonograph. Surgeons removed the appendix from a patient with local anaethesia, while jazz music entertained. At the right is shown a top being spun by radio at King's College, England.

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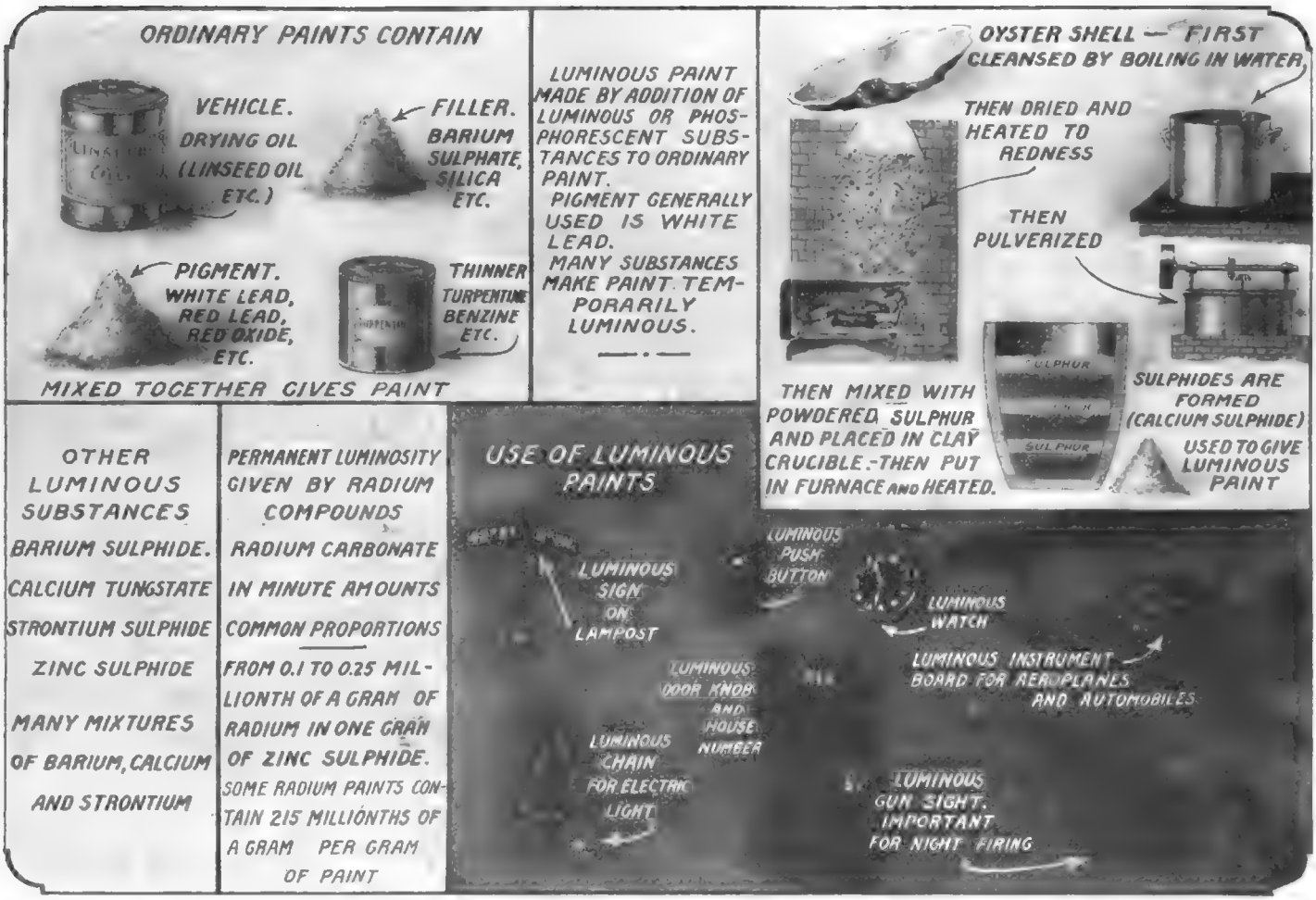
Making Luminous Paint

Methods Employed in its Manufacture


ORDINARY PAINTS CONTAIN
VEHICLE. DRYING OIL (LINSEED OIL ETC.)
FILLER. BARIUM SULPHATE, SILICA ETC.
PIGMENT. WHITE LEAD, RED LEAD, RED OXIDE, ETC.
THINNER TURPENTINE BENZINE ETC.
MIXED TOGETHER GIVES PAINT
LUMINOUS PAINT MADE BY ADDITION OF LUMINOUS OR PHOSPHORESCENT SUBSTANCES TO ORDINARY PAINT. PIGMENT GENERALLY USED IS WHITE LEAD. MANY SUBSTANCES MAKE PAINT TEMPORARILY LUMINOUS.
OYSTER SHELL — FIRST CLEANSED BY BOILING IN WATER,
THEN DRIED AND HEATED TO REDNESS
THEN PULVERIZED
SULPHUR
SULPHUR
THEN MIXED WITH POWDERED SULPHUR AND PLACED IN CLAY CRUCIBLE.-THEN PUT IN FURNACE AND HEATED.
SULPHIDES ARE FORMED (CALCIUM SULPHIDE)
USED TO GIVE LUMINOUS PAINT
OTHER LUMINOUS SUBSTANCES
BARIUM SULPHIDE.
CALCIUM TUNGSTATE
STRONTIUM SULPHIDE
ZINC SULPHIDE
MANY MIXTURES OF BARIUM, CALCIUM AND STRONTIUM
PERMANENT LUMINOSITY GIVEN BY RADIUM COMPOUNDS
RADIUM CARBONATE
IN MINUTE AMOUNTS
COMMON PROPORTIONS
FROM 0.1 TO 0.25 MILLIONTH OF A GRAM OF RADIUM IN ONE GRAM OF ZINC SULPHIDE.
SOME RADIUM PAINTS CONTAIN 215 MILLIONTHS OF A GRAM PER GRAM OF PAINT
USE OF LUMINOUS PAINTS
LUMINOUS SIGN ON LAMPOST
LUMINOUS PUSH BUTTON
LUMINOUS WATCH
LUMINOUS INSTRUMENT BOARD FOR AEROPLANES AND AUTOMOBILES
LUMINOUS DOOR KNOB AND HOUSE NUMBER
LUMINOUS CHAIN FOR ELECTRIC LIGHT
LUMINOUS GUN SIGHT. IMPORTANT FOR NIGHT FIRING

Almost all luminous paints have now some reference to radium in their names. However, only those used in the finest of work contain any of that costly substance. The foundation of all radiant paints is the ordinary garden variety of pigment and oil as shown in the first illustration. The pigment is usually a lead or zinc compound mixed with a filler and oil as in the ordinary process. To make it luminous a phosphorescent substance is added. This usually consists of a barium, strontium or calcium compound.

The phosphorescent calcium compound is obtained by heating oyster shells to redness in a kiln as shown in the right top illustration after they have been thoroughly washed in boiling water and steam. After they come from the kiln they are pulverized and mixed with sulphur and are heated together in a clay crucible, resulting in a compound that lends phosphorescence to the paint. The phosphorescence is temporary only.

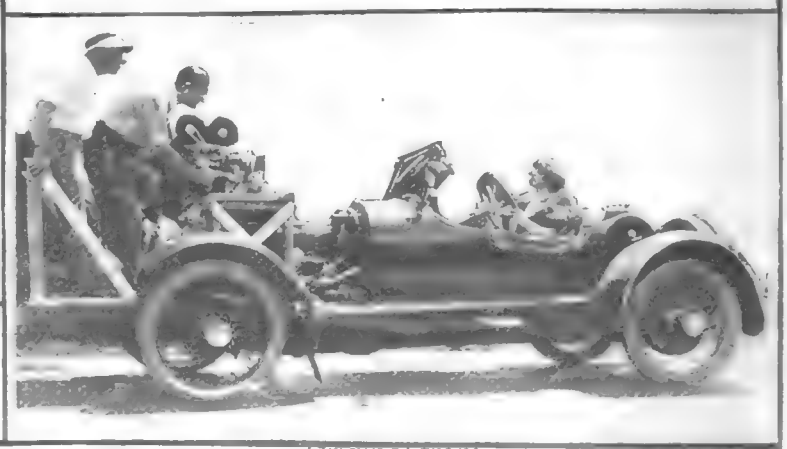
—Ismar Ginsburg, B. Sc., Chem., Eng.

New Girder

As a result of a great amount of experimenting the U. S. Bureau of Standards has evolved a metal compound called duraluminum which combines extreme strength with exceptional strength for use in the manufacture of metallic framework for aircraft. The above illustration shows graphically the strength and weight of the metal. Information as to the composition is not as yet available, but the preliminary tests conducted by the department tend to prove that it will open a new day for the aeronautical engineer.

Movie Speed

Did you ever wonder when a close-up of your favorite screen star (Miss Viola Dana here) was flashed on the screen careening across the country in her high-powered car, how the photographer managed it? Here we see how it is done. A platform is built on the front of the automobile and the camera made fast to it. As the car and star chase merrily on their way the cameraman grinds on. The vibration of the car and the moving countryside give the effect of speed. The cameraman's business in this case is hardly as safe as some other occupations one might mention, so a kind hearted property man has provided the protective railing around the platform as shown.



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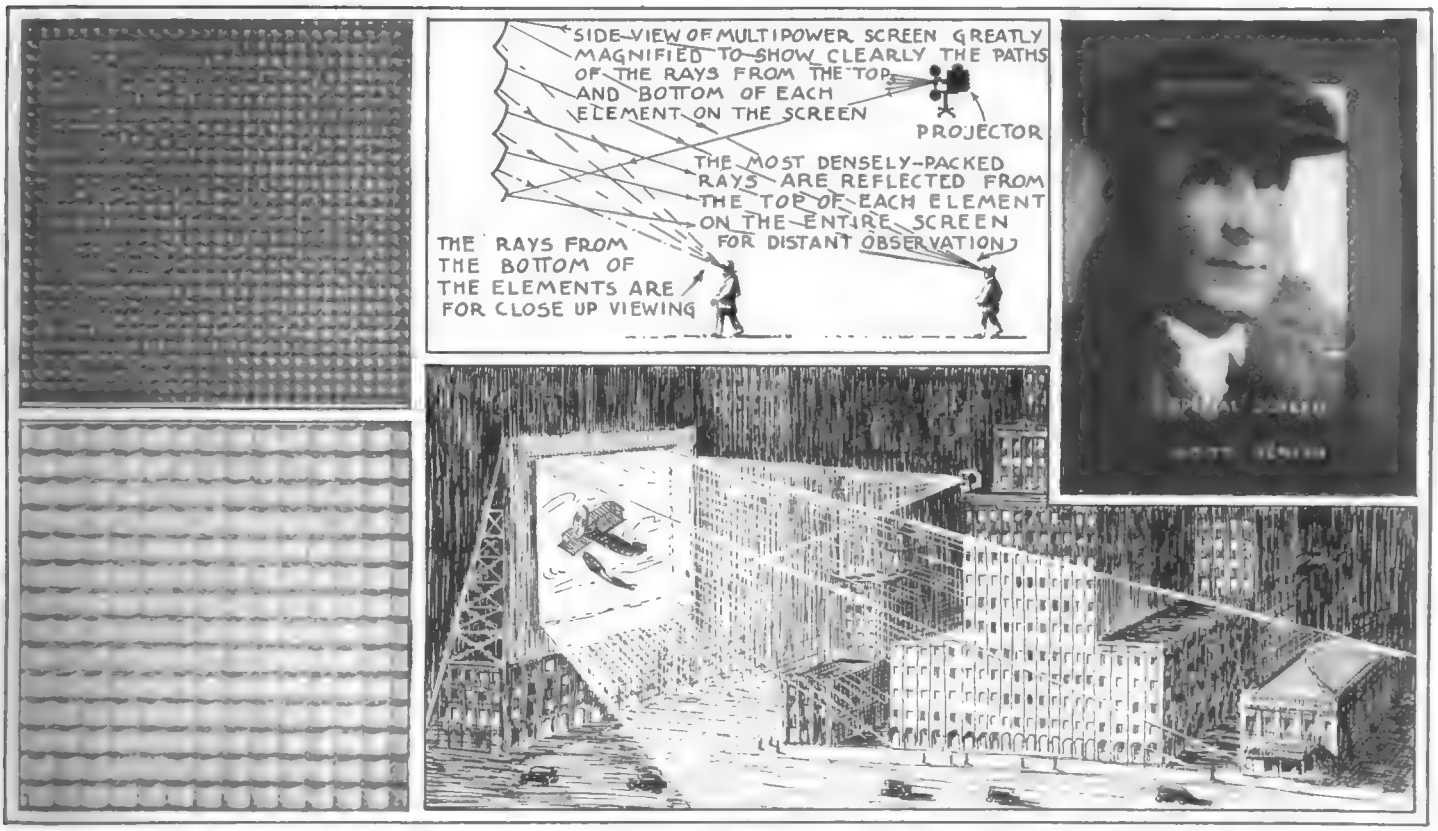
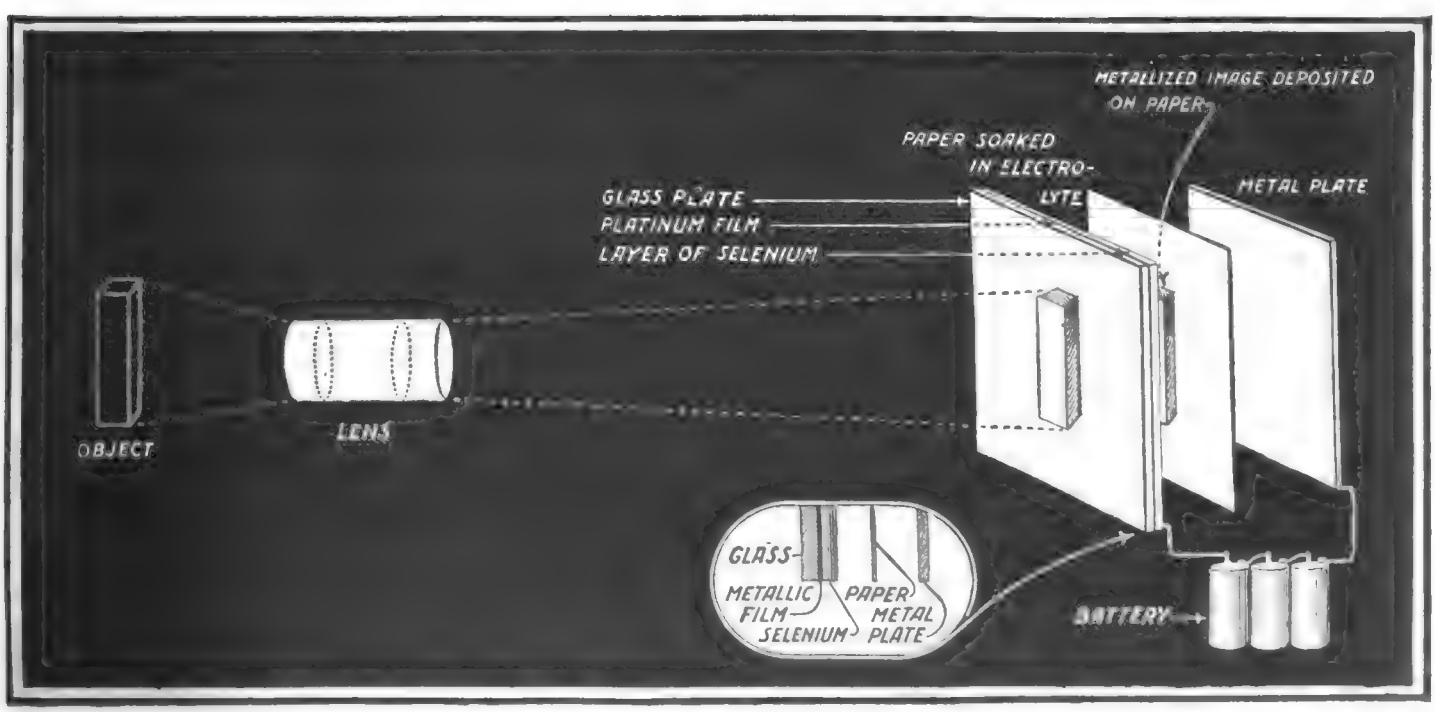
Multi-Mirror Advertising Screen

Reflecting Screen Is Made Like a Magnified Fly's Eye


SIDE-VIEW OF MULTIPOWER SCREEN GREATLY MAGNIFIED TO SHOW CLEARLY THE PATHS OF THE RAYS FROM THE TOP AND BOTTOM OF EACH ELEMENT ON THE SCREEN
PROJECTOR
THE MOST DENSELY-PACKED RAYS ARE REFLECTED FROM THE TOP OF EACH ELEMENT ON THE ENTIRE SCREEN FOR DISTANT OBSERVATION
THE RAYS FROM THE BOTTOM OF THE ELEMENTS ARE FOR CLOSE UP VIEWING

Actual tests on a metallic white screen demonstrate that the reflecting power of this screen is far greater than a sandblasted mirror or white drawing paper. Examples of the different types of screen used are shown at the left. Each has its own use. The usual procedure is to project upon the screen a photograph or the image of the advertisement. The reflection of the light is very intense in comparison to that of the ordinary white smooth surfaces. This is shown in the photograph in the upper right hand corner where the metallic screen was placed in the middle of a white sheet of paper. Notice how clearly defined the edges of the screen are and how perfectly sharp the features are reproduced where the light falls upon the metallic screen. This screen is made up of many minute curved elements, some of them not more than one square millimeter in size.

Photography With Electricity



Through the agency of selenium which is sensitive to light, a German scientist, Mr. K. Wilcke, has just evolved a method for taking photographs by placing a thin sheet of this metal upon a metallic film, usually of gold or platinum, and placing the whole against a piece of paper. An electric current is then passed from the selenium to the metal plate and the whole exposed to light. Where strong light falls on the selenium its conductivity is greatly increased, while its conductivity is proportionately less where the lights are not so strong. Through the electroplating principle, there is a deposit from the metal sheet to the paper giving fair reproduction of the object being photographed. This process has not been perfected for commercial use, but a number of scientists think that it holds great possibilities.

—Raymond Francis Yates.

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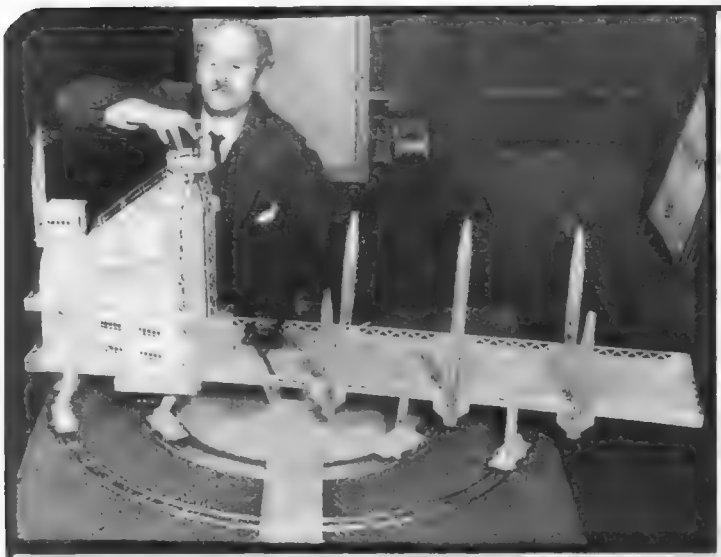
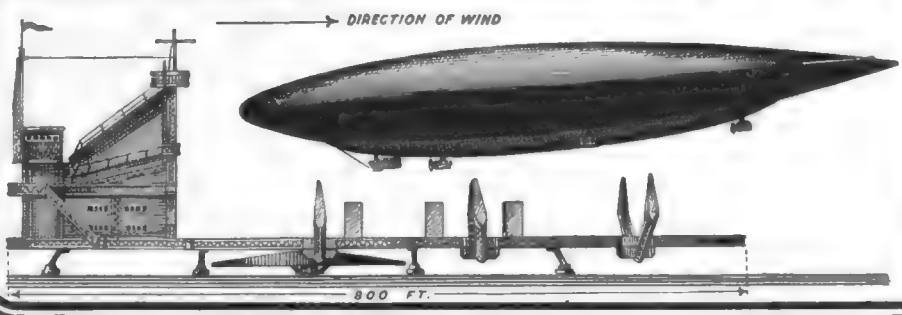
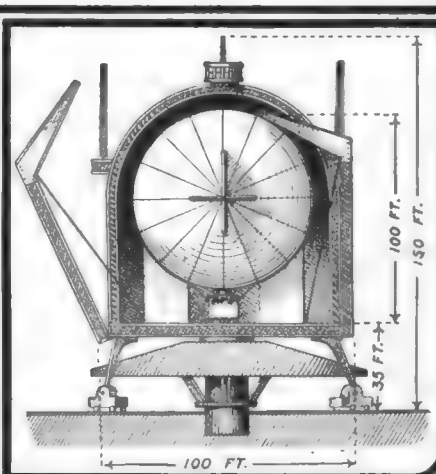
New Dirigible Hangar



A DISCOVERY ranking in importance with that of the mooring mast, as far as a lighter-than-air craft is concerned, is the new type dirigible hangar illustrated here. It is the invention of John Mason, a Philadelphia engineer. It consists of a long movable platform on which the airship rests. The platform rotates in much the same manner as a railroad turn-table, being supported on ordinary railroad trucks running on two circular tracks. On one end of the platform is a housing which takes the nose of the ship and houses machine shops, gas containers and crew quarters. There is also a powerful radio station included with the hangar. The hangar is rotated by electric motors and is so arranged as to always face into the wind. Along the sides of the platform are six steel braces that are movable as illustrated. When the ship is in place they fold over it, holding it in place. The photograph at the top left shows the inventor with a model of his dirigible housing which is being submitted to engineers of the U. S. Navy Department with a view to allowing the government control of the new invention. —Jos. P. Devir





Everyday Physics

UNDER ordinary conditions nothing is ever empty. A bottle or can may look empty, but it contains air. Before a so-called empty bottle may be filled, the air in it must be allowed to escape. One of the quickest methods to prove that a bottle is not empty is to attempt to fill it with water without allowing the air in it to escape. In the first photo above the boy at the left is trying to fill his bottle with the funnel jammed tightly into the neck of the bottle. The air cannot escape and as a consequence the liquid backs up in the funnel.

A light bulb is empty—nearly—since it is nearly evacuated. If the tip is broken off under water the water rushes in. Gas tanks on cars have small holes in the cap in order that air may replace the gasoline used by the engine. When emptying containers the air and liquid must run in and out at the same rate. Note how it is done in the picture at the extreme right. To obtain this condition in closed containers always have two holes in them; in a barrel a hole to admit air in the top. In the salad oil cans or condensed milk cans the same arrangement allows an even flow of the liquid from the container. —G. M. Garrard.

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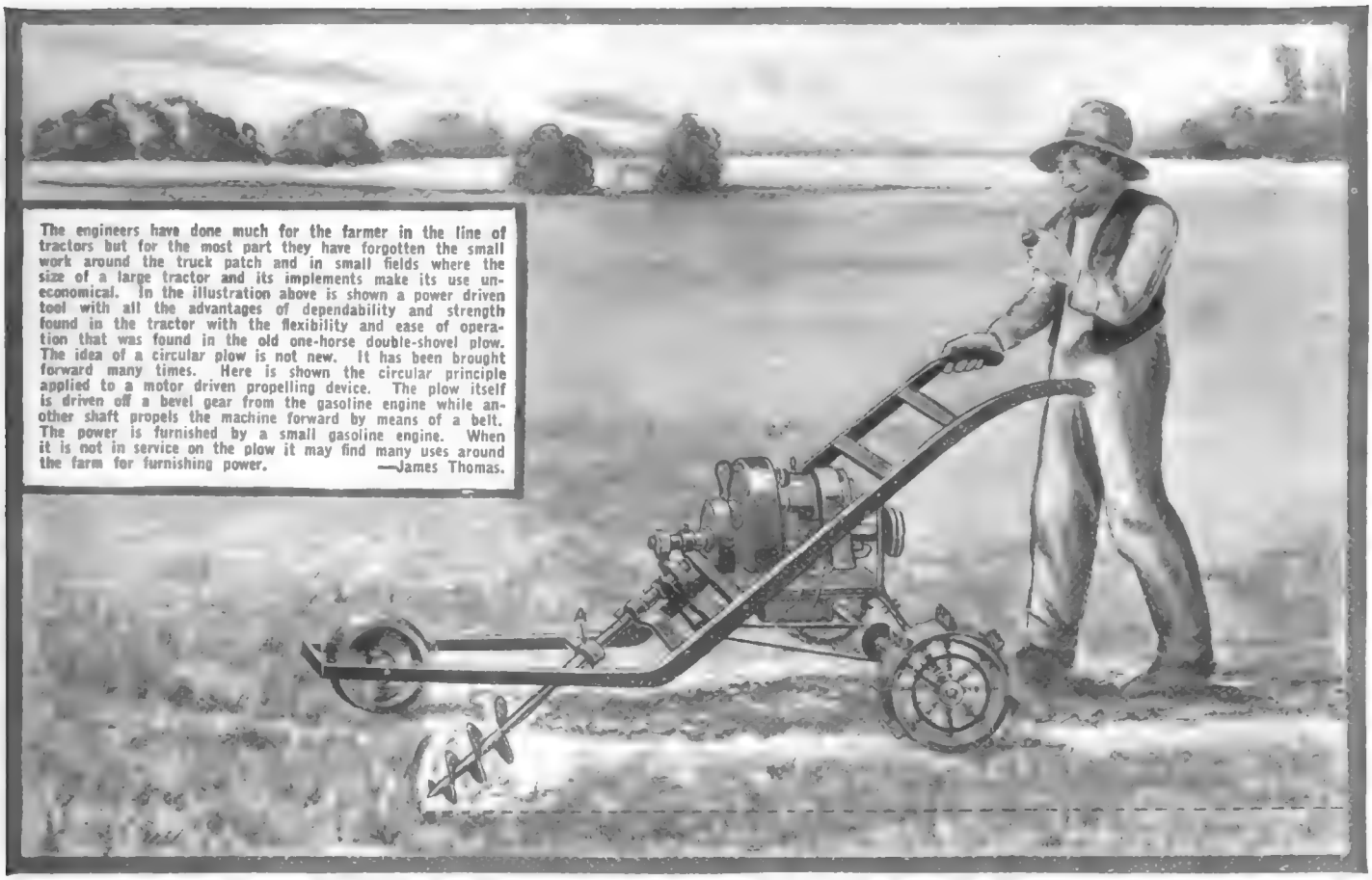
Rotary Plow and Cultivator

Motor Driven Plow That Will Serve Many Purposes



The engineers have done much for the farmer in the line of tractors but for the most part they have forgotten the small work around the truck patch and in small fields where the size of a large tractor and its implements make its use uneconomical. In the illustration above is shown a power driven tool with all the advantages of dependability and strength found in the tractor with the flexibility and ease of operation that was found in the old one-horse double-shovel plow. The idea of a circular plow is not new. It has been brought forward many times. Here is shown the circular principle applied to a motor driven propelling device. The plow itself is driven off a bevel gear from the gasoline engine while another shaft propels the machine forward by means of a belt. The power is furnished by a small gasoline engine. When it is not in service on the plow it may find many uses around the farm for furnishing power. —James Thomas.

Gas and Fire Hold-Up Preventer

A Safety-First Money Box for Transfers of Currency

END OF CORD IN MESSENGERS POCKET. WHEN HE SETS THE CASE DOWN AT THE "HANDS UP" COMMAND IT PULLS OUT AND PUTS HANDLE IN CIRCUIT
HANDLE - IF PICKED UP WHILE PLUG IS OUT MAKES CIRCUIT IGNITING CHEMICALS
VENTS FOR SMOKE AND FLAMES
SULPHUR MIXED WITH OTHER SECRET CHEMICALS THAT CAUSE CAUSTIC STINKING SMOKE THAT IS HEAVY AND LAYS CLOSE TO THE GROUND. SMOKE CONTINUES 15 MINUTES AFTER BOX IS PICKED UP.
PYROTECHNICAL MIXTURES CAUSING BLUE, RED, GREEN & YELLOW FLAMES TO SHOOT FROM THE PORTS OF THE BOX. SIMILAR TO RAILROAD FLARES
MONEY
DRY CELLS. CURRENT HEATS SMALL WIRE IN CHEMICALS INCANDESCENT CAUSING IGNITION

The most effective hold-up preventer that has so far made its appearance is the one illustrated above. Combining a warning with a unique defense method, its use makes it practically impossible for the thief to get away with his loot if he is successful in taking it from the person to whom it is entrusted. The device is simple, it consists of a heavy metal carrying case in which the money and the defensive apparatus is carried. There is a plug that is inserted in a receptacle in the case, the other end of which is carried in the pocket of the messenger or person carrying the money. At the command of "Hands Up" he jerks his hand from his pocket, tearing the plug from its connections. In so doing he connects a battery to the handle of the box. If the box is picked up after this plug has been removed a large amount of sulphur and other chemicals in the bottom of the box is ignited and flames issue from the holes around the bottom. A heavy gas that is suffocating to humans is released, making it impossible for the box to be removed. The flames signal for help. The money is tinted by the chemical action so that it will be detected when an attempt is made to pass it.

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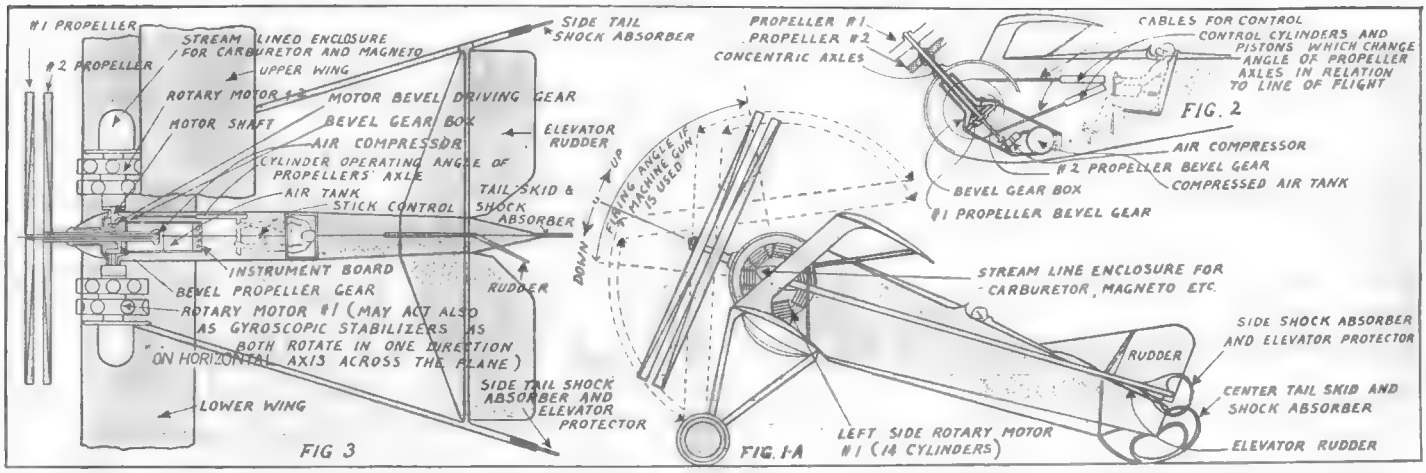
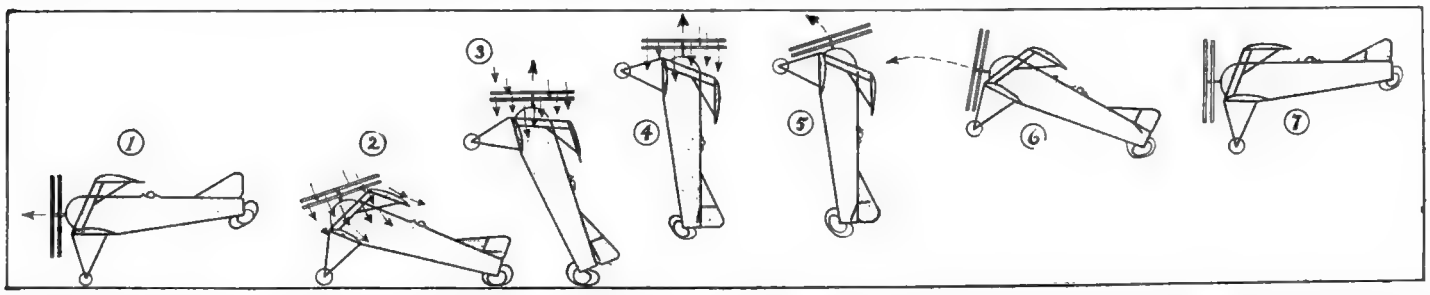
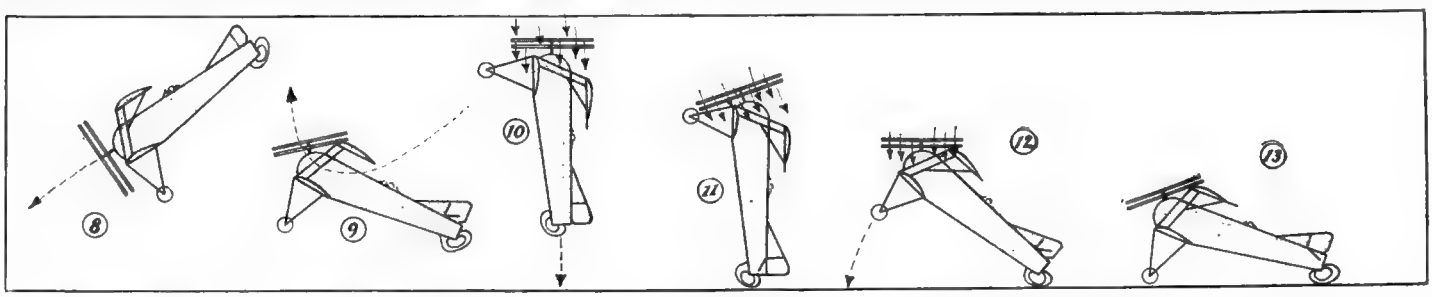
Airplane-Helicopter Flyer


#1 PROPELLER
#2 PROPELLER
STREAM LINED ENCLOSURE FOR CARBURETOR AND MAGNETO
UPPER WING
ROTARY MOTOR #2
MOTOR BEVEL DRIVING GEAR
MOTOR SHAFT
BEVEL GEAR BOX
AIR COMPRESSOR
CYLINDER OPERATING ANGLE OF PROPELLERS' AXLE
AIR TANK
STICK CONTROL
INSTRUMENT BOARD
BEVEL PROPELLER GEAR
ROTARY MOTOR #1 (MAY ACT ALSO AS GYROSCOPIC STABILIZERS AS BOTH ROTATE IN ONE DIRECTION ON HORIZONTAL AXIS ACROSS THE PLANE)
LOWER WING
SIDE TAIL SHOCK ABSORBER
ELEVATOR RUDDER
TAIL SKID & SHOCK ABSORBER
RUDDER
SIDE TAIL SHOCK ABSORBER AND ELEVATOR PROTECTOR
FIG 3
FLYING ANGLE IF MACHINE GUN IS USED
UP
DOWN
PROPELLER #1
PROPELLER #2
CONCENTRIC AXLES
CABLES FOR CONTROL CONTROL CYLINDERS AND PISTONS WHICH CHANGE ANGLE OF PROPELLER AXLES IN RELATION TO LINE OF FLIGHT
FIG. 2
AIR COMPRESSOR
#2 PROPELLER BEVEL GEAR
COMPRESSED AIR TANK
BEVEL GEAR BOX
#1 PROPELLER BEVEL GEAR
STREAM LINE ENCLOSURE FOR CARBURETOR, MAGNETO ETC.
SIDE SHOCK ABSORBER AND ELEVATOR PROTECTOR
RUDDER
CENTER TAIL SKID AND SHOCK ABSORBER
ELEVATOR RUDDER
LEFT SIDE ROTARY MOTOR #1 (14 CYLINDERS)
FIG. 1-A

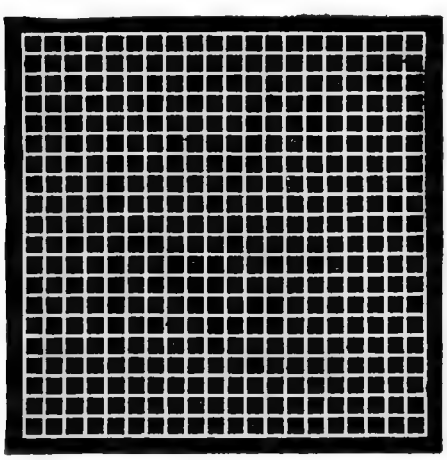
The small plane with the aid of two large propellers rotating in opposite directions is lifted almost vertically from the ground by tilting the propellers to a horizontal angle. The length of the propellers is one-third of the wing length. The motors that drive them through bevel gears are of the rotary variety and are mounted outside the fuselage for cooling. The plane is equipped with both horizontal and vertical rudders which are controlled by cables to the stick and wheel. The propeller angle is changed by air cylinders.



Above is shown the angle of tilt of the propellers used in raising the plane from the ground tilted straight up first and then down to pull the plane into horizontal flight as it rises. Below—method of landing. As plane nears ground it is suddenly nosed upward to check forward speed. The propellers are slowed down so plane lands on tail. —Ramon Oriol.

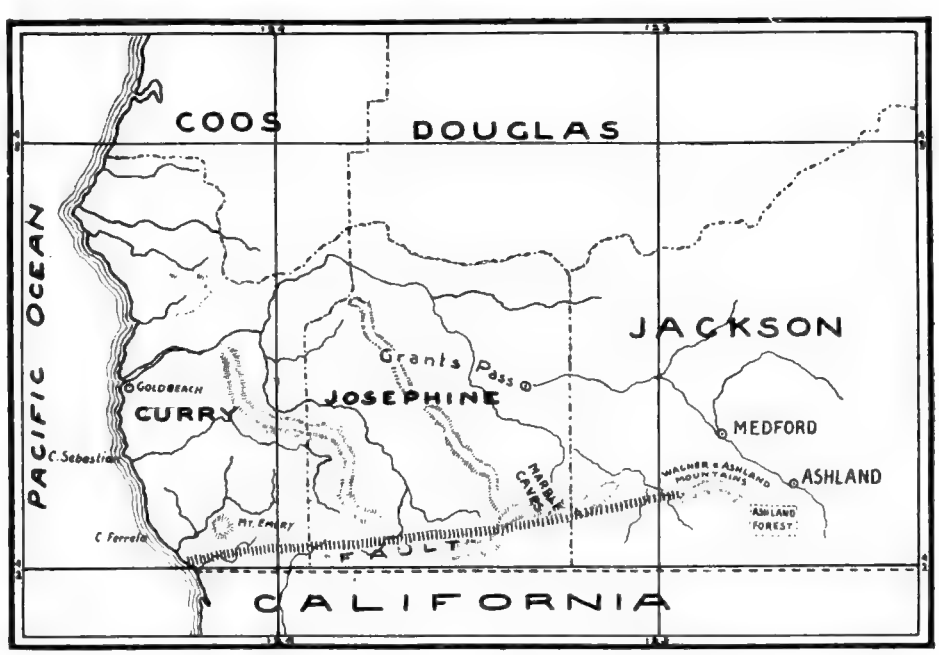


OPTICAL ILLUSION



Look at the above grating in the regular way. Then hold it about one and one-half inches away. The white lines will appear dark. Look at it through small hole in card. The horizontal lines will disappear. Looking through the hole at regular focal distance vertical lines disappear.

Natural Seismograph



At right is shown map of marble caves and geologic fault that runs through them in southern Oregon. When there are seismic disturbances anywhere in the Western Hemisphere this fault, sixteen feet wide in the cave, emits growls and groans. —R. Kemp Welsh.

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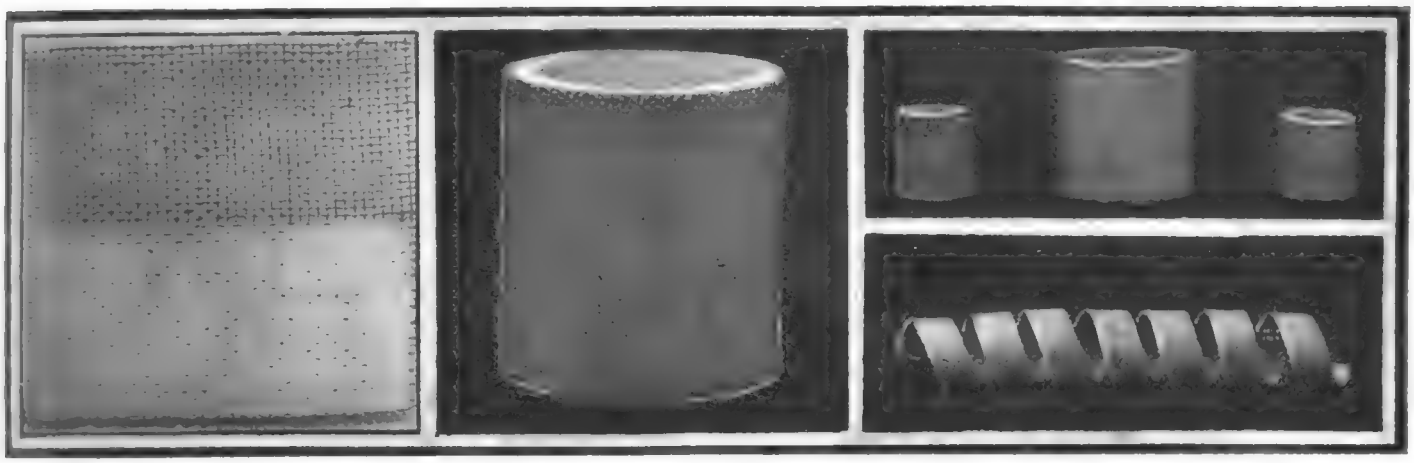
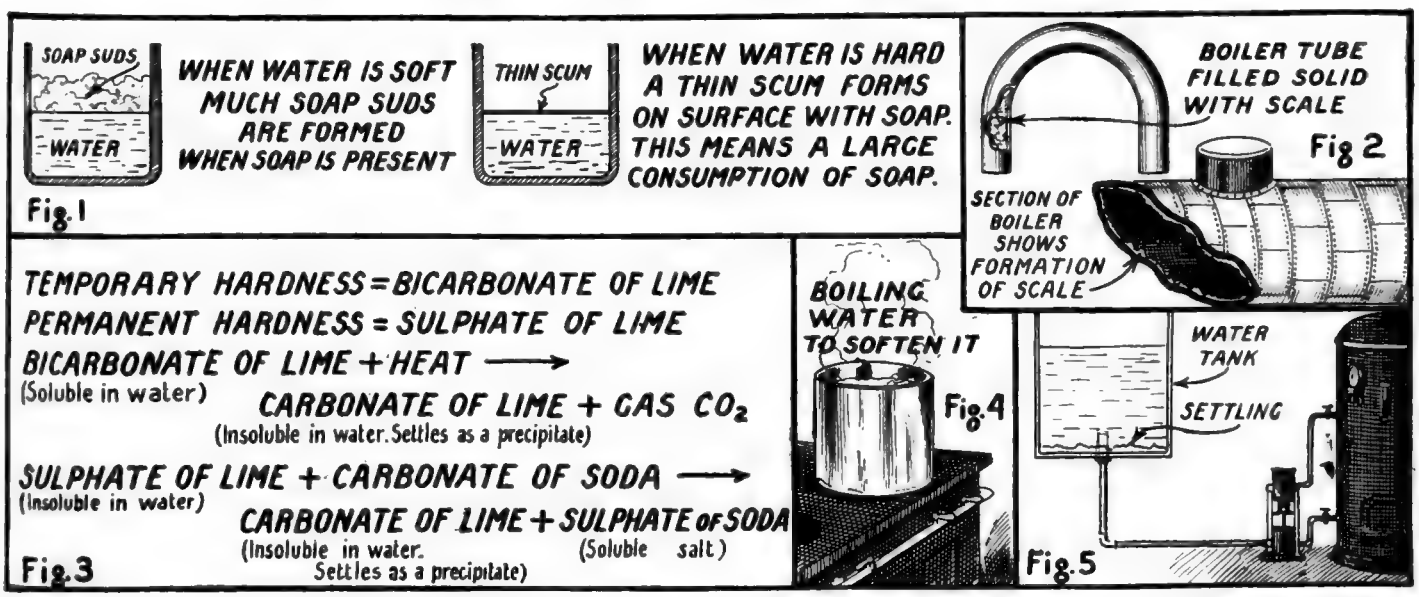
New Refractory Ceramic



A discovery recently made by a German scientist, which promises to be of the utmost importance to metallurgical workers, is illustrated above. By using an ordinary refractory ceramic material and placing within it a wire mesh, which acts as a reinforcement, a substance has been evolved which will withstand the ultra-high temperatures necessary in many branches of scientific work, and at the same time is capable of comparatively rough handling. It can be heated a dull red and plunged in water with no damage. The name of the new material is Ceramonite and illustrations of the completed article are shown in the pictures above. The wire which acts as reinforcement binds firmly with the material.—Dr. Albert Neuberger

Kinks for Softening Water


SOAP SUDS
WATER
WHEN WATER IS SOFT MUCH SOAP SUDS ARE FORMED WHEN SOAP IS PRESENT
THIN SCUM
WATER
WHEN WATER IS HARD A THIN SCUM FORMS ON SURFACE WITH SOAP. THIS MEANS A LARGE CONSUMPTION OF SOAP.
Fig. 1
TEMPORARY HARDNESS = BICARBONATE OF LIME
PERMANENT HARDNESS = SULPHATE OF LIME
BICARBONATE OF LIME + HEAT ⟶
(Soluble in water)
CARBONATE OF LIME + GAS CO_2
(Insoluble in water. Settles as a precipitate)
SULPHATE OF LIME + CARBONATE OF SODA ⟶
(Insoluble in water)
CARBONATE OF LIME + SULPHATE OF SODA
(Insoluble in water. Settles as a precipitate)
(Soluble salt)
Fig. 3
BOILER TUBE FILLED SOLID WITH SCALE
Fig 2
SECTION OF BOILER SHOWS FORMATION OF SCALE
BOILING WATER TO SOFTEN IT
Fig. 4
WATER TANK
SETTLING
Fig. 5

The best method of detecting hardness of water is to dissolve soap in it and shake. If the water is soft, thick foamy lather will appear on top; if the water is hard, the soap will have little effect other than forming a thin scum on top of the water. The comparative hardness or softness of the water may be judged by how it lathers. There are two kinds of hardness, temporary and permanent. There is little trouble with the temporary hard water, since it may be softened by boiling. The temporary hardness is usually caused by bicarbonate of lime (calcium bicarbonate), which, when heated, forms carbonate of lime (calcium carbonate) and carbon dioxide. The salt is precipitated and the gas escapes, leaving the water soft. The permanent hardness is caused by sulphate of lime (calcium sulphate). The only way to soften water containing this salt is by adding some solution which will precipitate the salt in an insoluble state. If carbonate of soda (sodium carbonate) is added to the water containing the lime salt, carbonate of lime (calcium carbonate) is precipitated and sulphate of soda (sodium sulphate) is formed, which is soluble. —Ismar Ginsburg, B. Sc.

Blond Hair Longer Than Brunette

After making a long study of the matter, German scientists recently announced that the ordinary blonde has more hair by about forty-four miles than her dark sister. Above is graphically illustrated the comparison of the lengths of the two types of hair. The scientists found in their studies, which dealt with a large number of typical German women, that the hairs of a blonde were in all cases much finer and greater in number than those of the brunette. They also found that while the blonde has the superior amount of hair, the brunette is best suited to carry her crowning glory through life, since the dark hair was found to have a greater cross-sectional area and possessed much greater strength. It was found that the ordinary blond hair would sustain only sixty-eight grams, while the hair of a dark-complexioned person would sustain approximately one hundred and thirteen grams.

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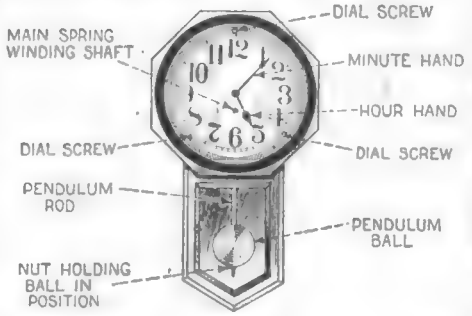
Timely Talks on Timepieces

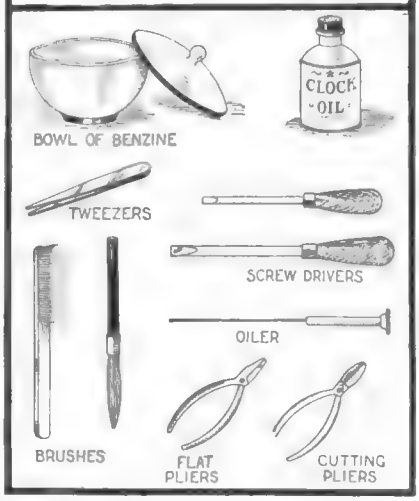
No. 3 of a Series. The Repair of Clocks

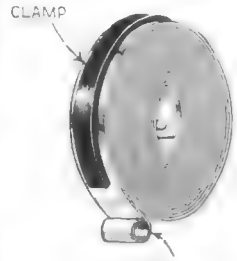
By SAMUEL BERNARD



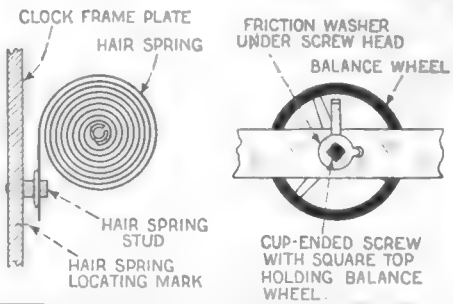
In order to get at the works of a clock, it is first necessary to remove the pendulum, face and hands of the timepiece. Remove the pendulum by raising the pendulum rod up a little, and taking it off the suspension wire. Remove the hands by pushing out the small pin inserted across the center arbor, then take out the screws holding dial.

Below are shown the tools and materials required in making ordinary repairs on clocks. Notice that the materials required are few; that the tools may be obtained from the tool chest, and Sister will gladly lend you her tweezers.

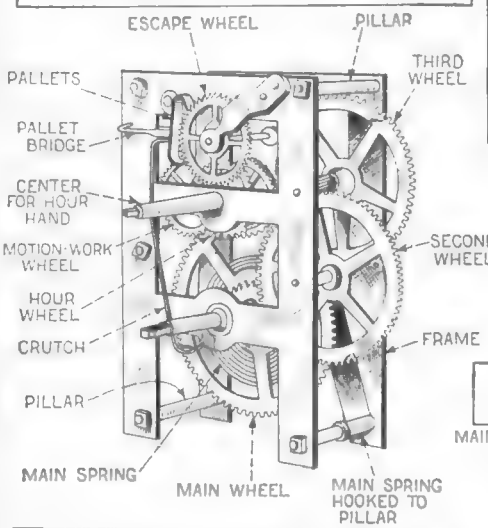




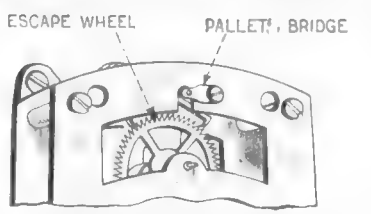
In some clocks the main spring has no case or barrel. The inner end of the spring is hooked to the arbor of the main wheel in the usual way, and the outer end is formed into a loop, which is slipped on one of the frame pillars. A piece of iron wire should be slipped around these main springs to hold them.



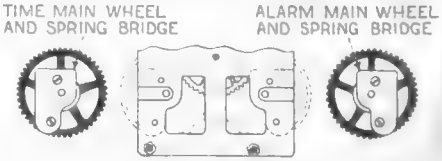
To take the clock apart if it has hair spring, mark the spot where the hair spring ends, take the pin out of the stud, loosen screws holding balance wheel, and remove balance wheel and spring.



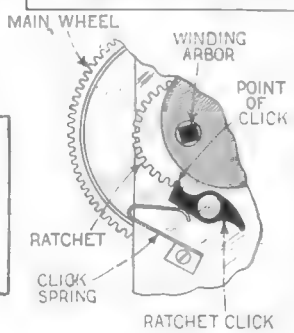
The above diagram clearly shows the movement of a pendulum clock after it has been removed from the case. By familiarizing one's self with the parts here shown, it will not be difficult to understand how to make small repairs, and how to start again that old "Grandfather's Clock" which has probably not run for a great many years. Notice how the main spring is hooked to the pillar and position of the crutch.



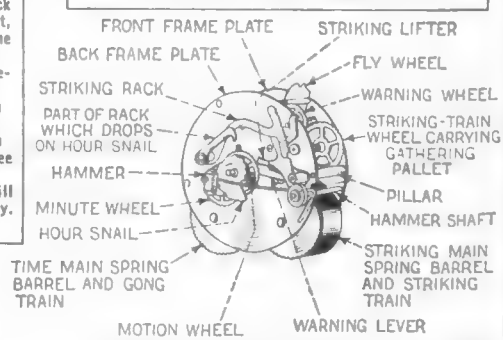
In high-grade clocks, the pallets are mounted between the frame plates as shown above.

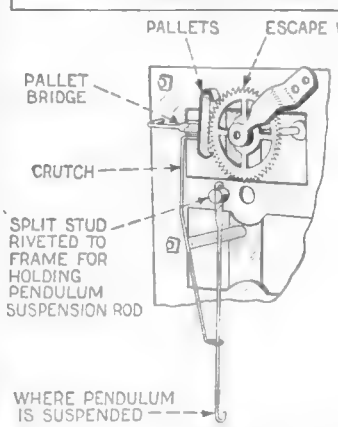


On some clocks, the main spring and main wheel is held in the clock frame by a bridge and a couple of screws. By taking off the plate, both springs may be easily slipped out.

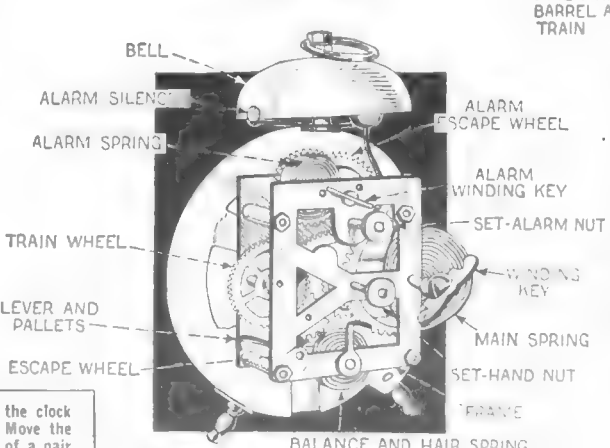


In taking clock movements apart, the power of the main springs must first be released. Insert key in winding arbor; turn a little as though winding and free ratchet. Unwind slowly, still holding the key.





Pour enough benzine into a dish to cover the clock movement when it is put into the dish. Move the pallet bridge off the pallets with the aid of a pair of tweezers. Lift the pallets off and put the movement in the benzine. Let it run down. This tub-like bath will clean the clock thoroughly. Clean pallets and suspension wire and when movement is dry, assemble and oil main springs.



Above is shown the movement of the ordinary alarm clock with the bell and legs in place. Of course in removing an alarm clock from the case, it is necessary to detach the bell, legs, winding keys, etc.

The striking mechanism of a clock may be seen in the diagram given here. The steps of the snail are arranged so that at 1 o'clock, it permits only sufficient motion of the rack for one tooth to be gathered up by the gathering pallet. At every succeeding hour an additional motion is possible. Simultaneously with the moving of the striking rack, the hammer strikes the gong.

In reassembling an alarm clock, and with the alarm hand at let us say, 9 o'clock, you should set the hour hand at nine and the minute hand at 12 so the alarm rings properly.

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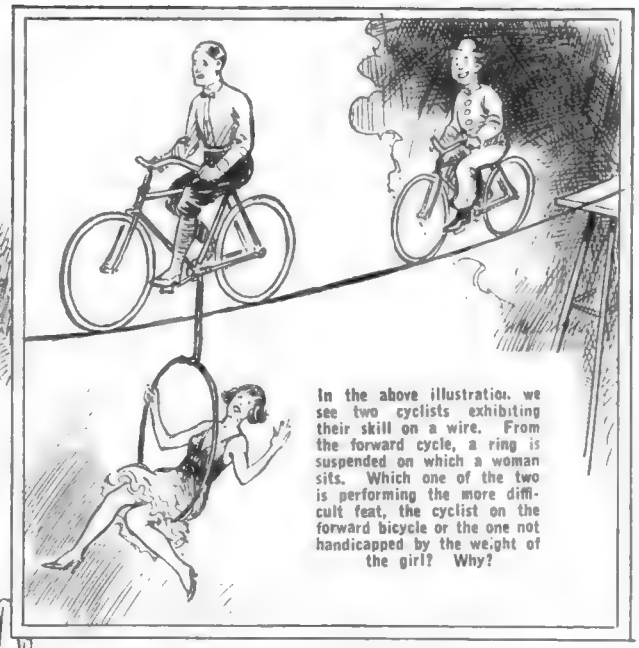
Scientific Problems and Puzzles

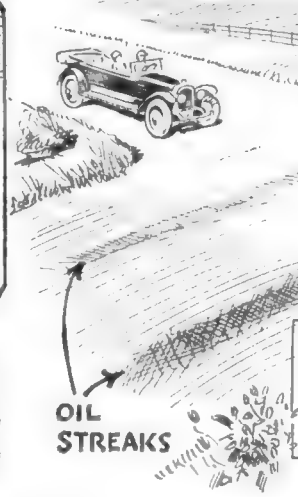
By ERNEST K. CHAPIN



In the above illustration, we see two cyclists exhibiting their skill on a wire. From the forward cycle, a ring is suspended on which a woman sits. Which one of the two is performing the more difficult feat, the cyclist on the forward bicycle or the one not handicapped by the weight of the girl? Why?

A man starts running around the edge of a large disk which is free to turn about a vertical axis. Will the wheel rotate as he runs? If unretarded by friction, will the wheel speed up as the man runs with constant rate around the rim? What will happen if the man suddenly stops? What if he pursues a spiral course towards the center of the revolving disk?

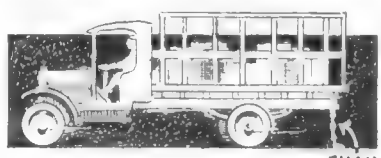
It is claimed that smoke rising straight up from a chimney is a sign of good weather, and that when it settles quickly, it is an indication of foul weather. Is there any scientific basis for this belief or is this purely superstition?



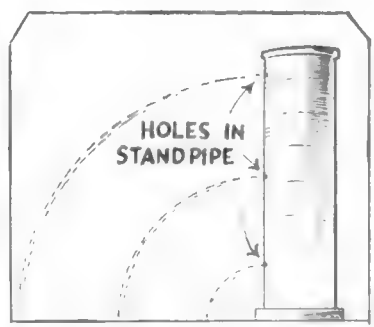
The oil streak left by automobiles is usually more prominent on one side of a pavement leading from a large city, than on the other. How could the tourists use this fact to guide them to their destination?

Why is it easier to balance a baseball bat with the handle end down, than with the handle end up?

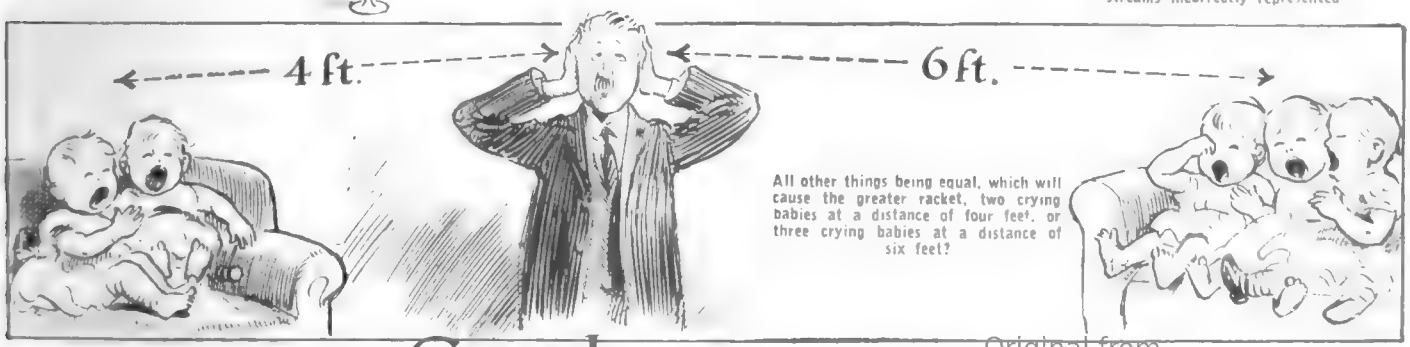
If a stick is balanced across a couple of wine glasses, it is possible to break the stick in the middle by striking it smartly with a poker without damaging the glasses though the glasses may not be as strong as the stick. Why?



Why are trucks which are used in the transportation of gasoline, including tank cars and other types of motor transports, provided with a chain that drags along the ground? This chain will be found on nearly every automobile used in transporting highly inflammable liquids.



If a standpipe developed three leaks, one near the top, one near the bottom, and one near the middle, would not the streams of water pour out of these holes in the manner shown in the diagram? If not, in what ways are the streams incorrectly represented?



All other things being equal, which will cause the greater racket, two crying babies at a distance of four feet, or three crying babies at a distance of six feet?

Answers to these problems appear on page 194

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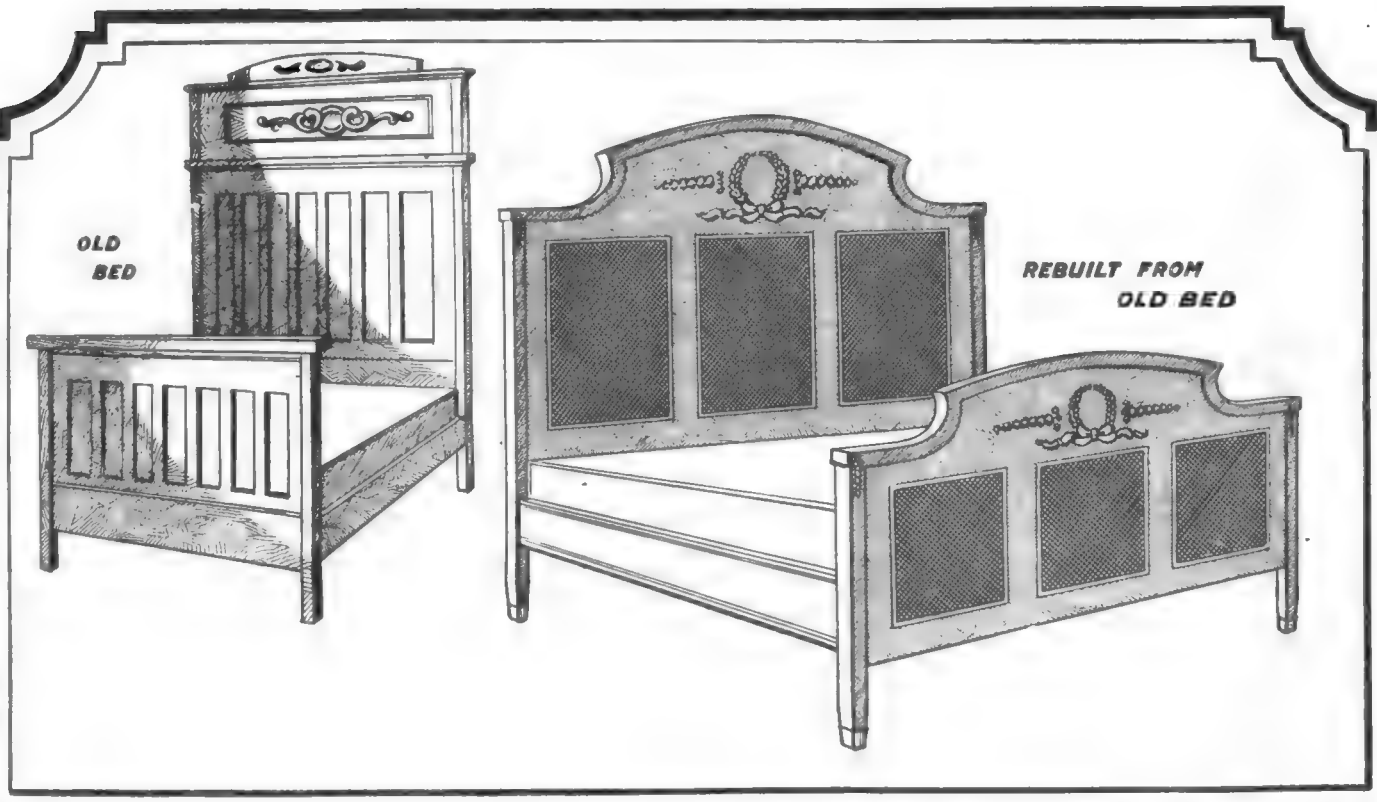
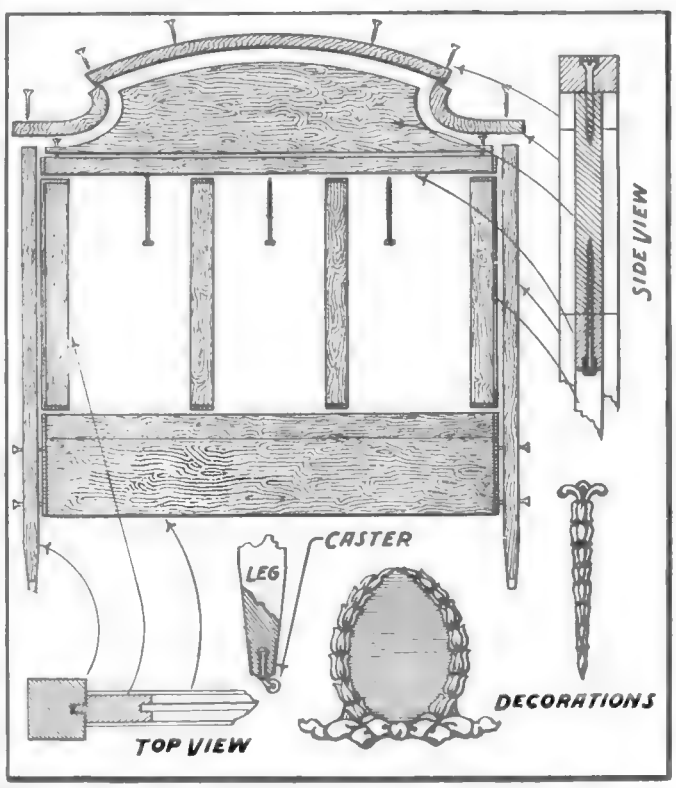
Home Mechanics

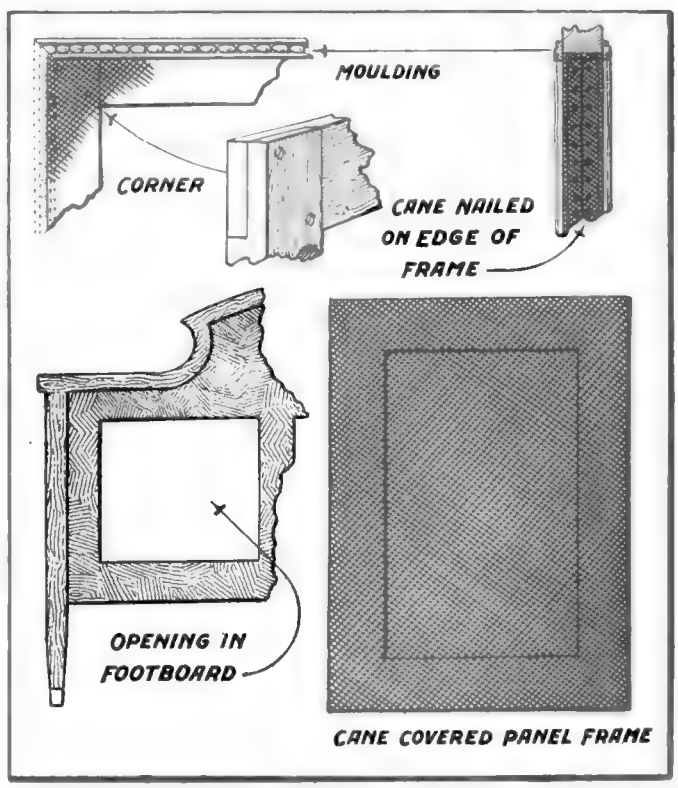
A Reconstructed Bedsted Having Cane Panels.

By WILLIAM BUTTERFIELD



The drawings here show how an old walnut bed, discarded many years, was utilized as the skeleton for a modern type bed with cane panels, the aristocratic appearance of which is at once apparent from the picture above at the right. The only mill work was that required for the six curved sections forming the top of the head and foot of the bed respectively. The wooden beading used to hold the cane panels in place and the imitation wood carving were obtained at a cabinet shop. The cane is obtainable by the yard and is machine braided. The cane is sometimes left plain or it may be varnished. If the builder is handy with tools he may make all the parts for the structure.





The drawings above show in detail how the head and foot of the bed were laid out and assembled. The details for the head and foot are identical. Each wooden leg was tapered and covered at the bottom with a brass cup, then fitted with a fiber roll caster. The parts of the old bed supplied the necessary tongue and groove sections for the new piece of furniture. Wood screws and lag screws were used to aid in gluing as well as for added strength. The old varnish was softened with wood alcohol and removed with a wire brush; the bedsted was re-stained and varnished to represent mahogany. The cane is thoroughly dampened before tacking in place on the frames; it stretches tight when dry.

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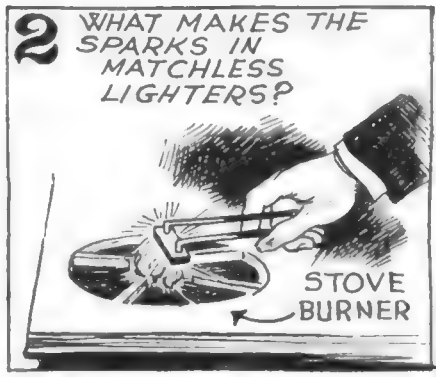
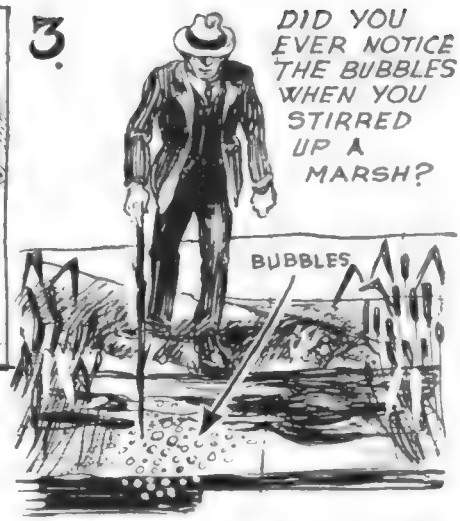
Everyday Chemistry

By RAYMOND B. WAILES

Lye or caustic soda, especially if hot, will attack aluminum just as it will attack clothes and flesh. Its action is similar to acid eating away zinc or other metal. Few housewives realize that boiling soap suds in aluminum kitchen utensils slowly but surely eats away the aluminum. Hydrogen gas is formed when the lye attacks the metal.

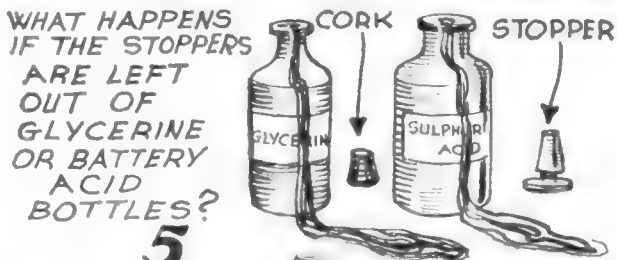


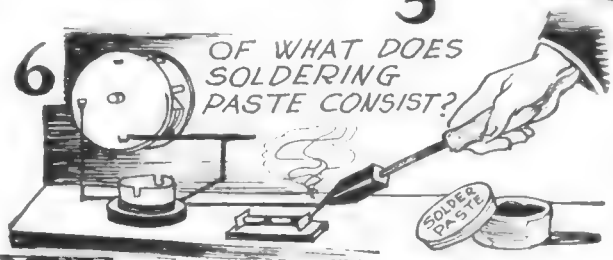
The plate of metal upon which the little file or scratcher rubs is Auer metal. This consists of an alloy of iron and cerium in almost equal proportions. The metal cerium has but little use in the world of science, although it is sometimes employed in medicines for seasickness and used in Welsbach mantles.



Most of us have undoubtedly had the bubbles which rise to the surface of marshes when the mud is stirred up explained as air bubbles. In reality they consist of a large proportion of marsh gas or methane. The gas will burn if collected by allowing it to fill an inverted bottle filled with water. This gas is also present in illuminating gas.

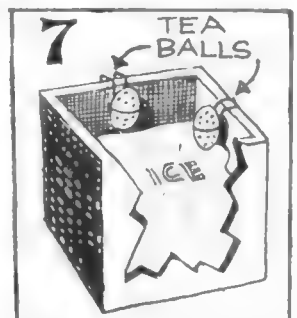
Many queer things are found in odd places in Nature. Biological chemists can tell you that oysters contain the metal zinc in a certain form. It is not yet understood how this metal gets in the oyster.



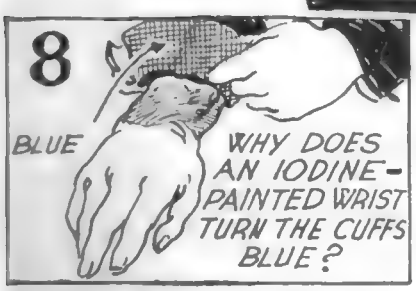


Soldering paste usually consists of tallow, sal ammoniac and zinc chloride. In radio soldering the last traces of pastes of this kind should be removed with alcohol. An excellent paste can be made by mixing equal parts of vaseline and sal ammoniac.

Quite a few substances we meet with in every-day life are hygroscopic. They actually absorb water from the air somewhat as a sponge does when placed in a container of water. Glycerine, strong sulphuric acid and alcohol greedily abstract water from the air. It is for this reason that 95 per cent alcohol is met with.



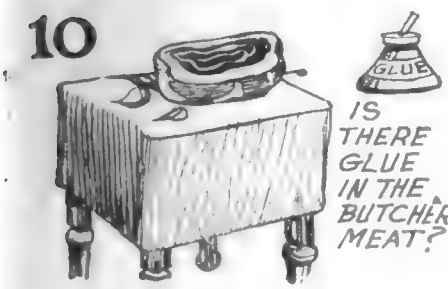
Charcoal has a marked property of absorbing gases in its pores. The property of absorptive charcoal can be made use of by filling tea balls with it and hanging them in refrigerators to remove odors. Rejuvenate every few weeks by baking in an oven.



When iodine meets starch, both substances put on their blue dresses. Iodine dropped on a cut potato will turn blue. An iodine painted wrist will turn the cuff sleeve blue, because of the starch which is usually in the sleeve.

9
FELT TACKED TO STOPPER OF BOTTLE
A WATERPROOFING WINDSHIELD WIPER
THE SOLUTION IS A MIXTURE OF EQUAL PARTS HOUSEHOLD AMMONIA, ALCOHOL AND GLYCERINE

Water dims the vision through windshields because it does not spread over the windshield in an even layer. When glycerine is rubbed on the windshield the water runs over the surface evenly instead of sticking in drops.



There is no glue in butcher's scraps or even in horse's hoofs. There is, however, a substance called chondrine in such scraps which produces glue when it is boiled with water.

A peculiar substance called nitrogen iodide can be made by mixing household ammonia and tincture of iodine. Pour on blotting paper and allow to dry. When touched with a feather, the dry substance will explode. All brands of ammonia do not produce the desired result. Be careful with it.

Another use for tincture of iodine. Major Schroeder used a bit of it in his gasoline when he made his record altitude. Iodine reduces engine knock to some degree and does not injure engine parts as do such impurities as sulphur which is often contained in gasoline and oils.

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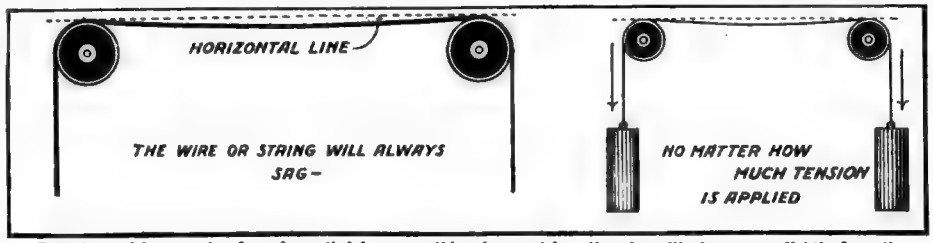
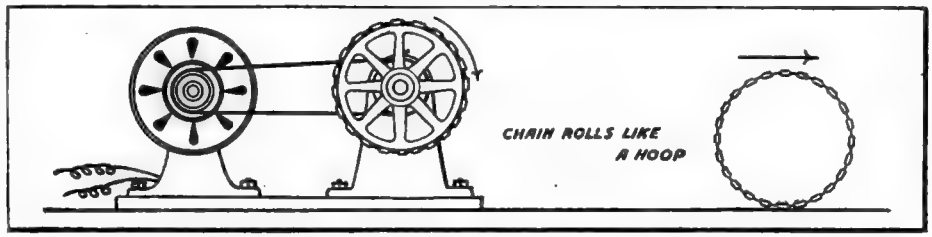
Scientific Curiosities

Strange Truths of Physics Easily Explained

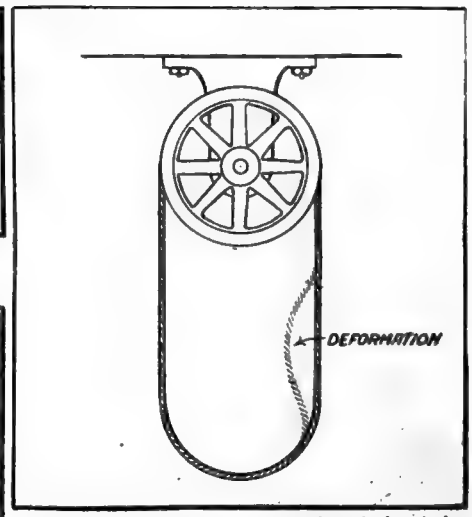
By O. IVAN LEE, B.Sc.



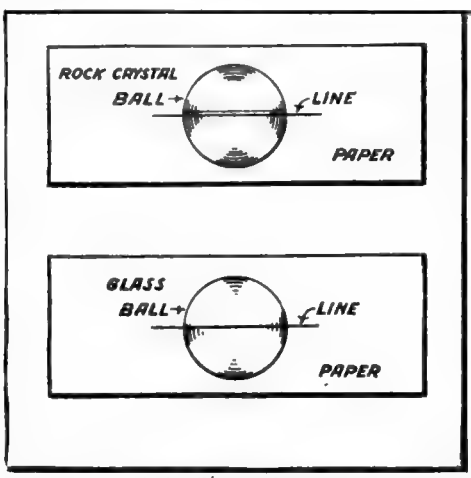
Regardless of how great a force is applied to a very thin wire or string, the wire will always sag slightly from the true horizontal. Even if the tension applied to the wire would cause the wire to break, it would be impossible to produce a true horizontal line by the taut wire up to the breaking point.



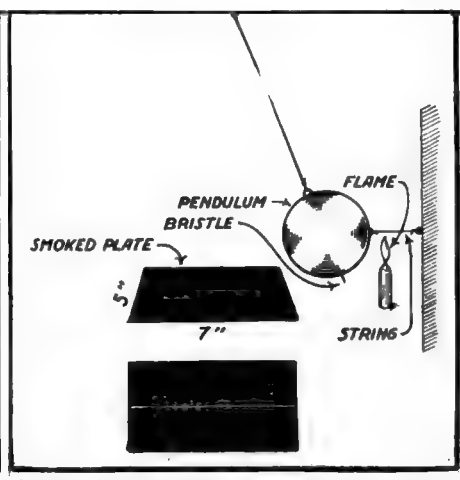
If a chain is wrapped around the rim of a wheel like a tire and is suddenly displaced after the wheel has been revolving rapidly, the chain will rotate in the direction shown and run along the ground for some distance before collapsing. Centrifugal force has temporarily endowed the chain with the properties of a rigid body.



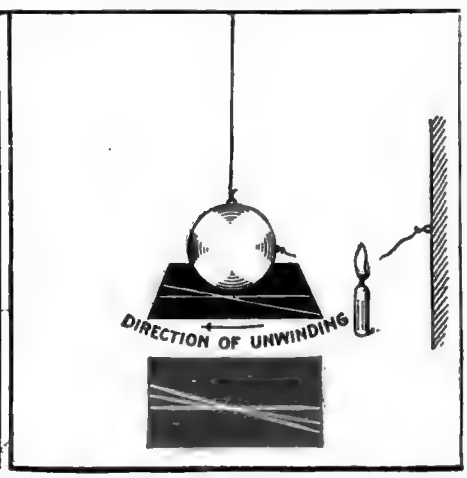
If a rope is suspended from a revolving wheel and violently struck with a heavy rod, it will be deformed much the same as if it were a piece of lead pipe. The rope will retain the shape given to it by the blow and the deformation will persist for some time.



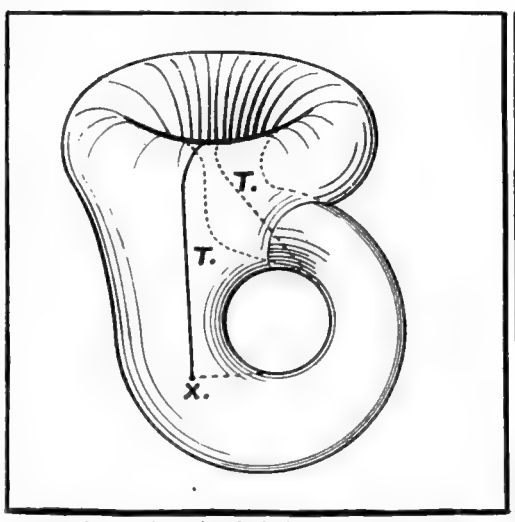
In order to tell the difference between a ball of rock crystal and a glass ball, the ball should be rotated in different directions over a fine hairline marked on paper. In a glass ball the line will always appear single. In certain positions of the rock crystal ball, two lines will appear.



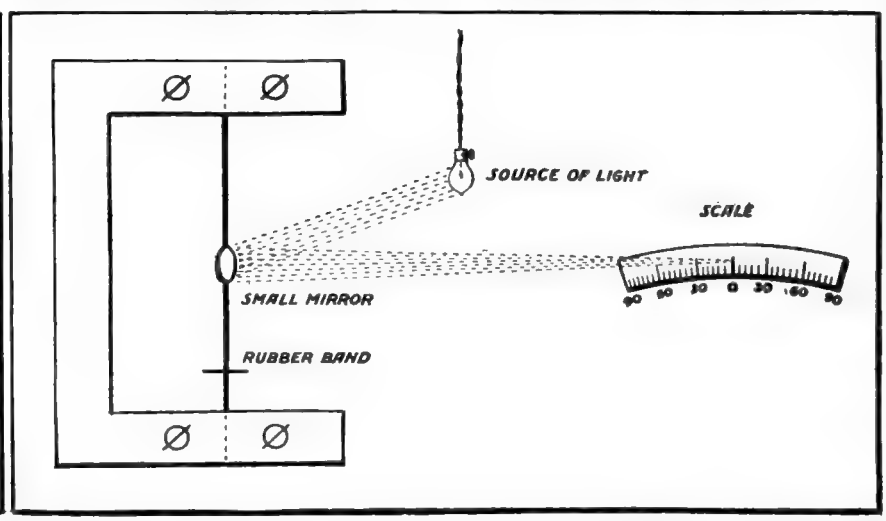
In order to determine why a baseball curves, a wooden croquet ball is suspended from the ceiling by a piece of thread and arranged to swing close to the floor. A small hole is drilled into the bottom and a bristle inserted with glue. Underneath is placed a pane of smoked glass. The bristle should touch the plate as it swings.



The ball is drawn to one side, and tied. The thread is then burned, causing the ball to vibrate, leaving a single straight line. If the pendulum bob is twisted for a considerable number of turns, and the ball again released, the plate will have a series of lines. A similar effect is noted in the flying baseball.



The above curious shaped sheet of metal has neither inside nor outside. To prove this, punch a small hole in any point (X) upon its surface, and pass a thread (T) through the hole. It will always be found possible to tie the ends of the thread together.



Studying the storage of strain in a rubber band. A small dental mirror is fastened to the center of a thick square rubber band. A horizontal paper scale is placed at some distance so that a light will be reflected from the mirror to the zero mark of the scale. If the rubber band is twisted to the left 30° and then released, the spot of light will return to the starting point after first passing it. After marking this deflection, the band is again turned to the left and then without releasing given the same twist to the right and released. Both movements are reproduced by the band.

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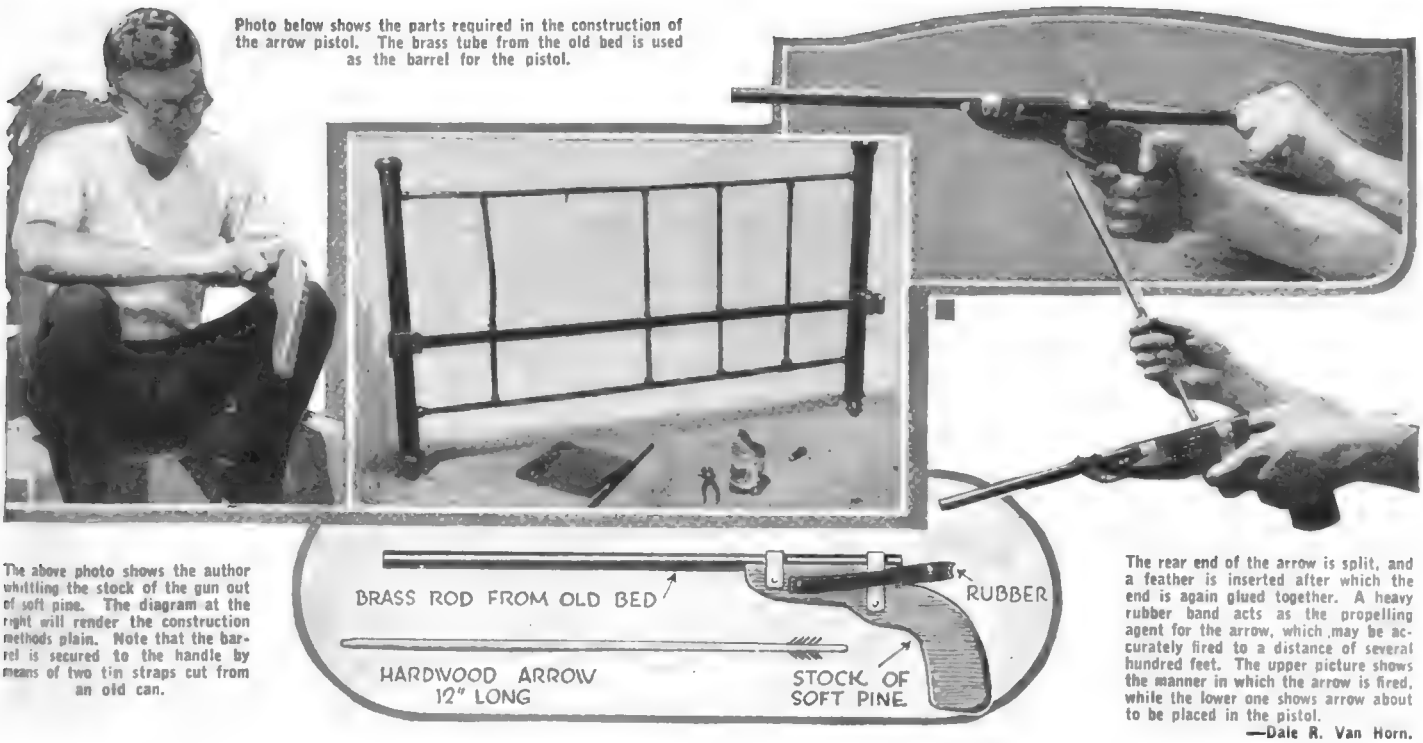
THE CONSTRUCTOR

How to Make an Arrow Pistol

Photo below shows the parts required in the construction of the arrow pistol. The brass tube from the old bed is used as the barrel for the pistol.

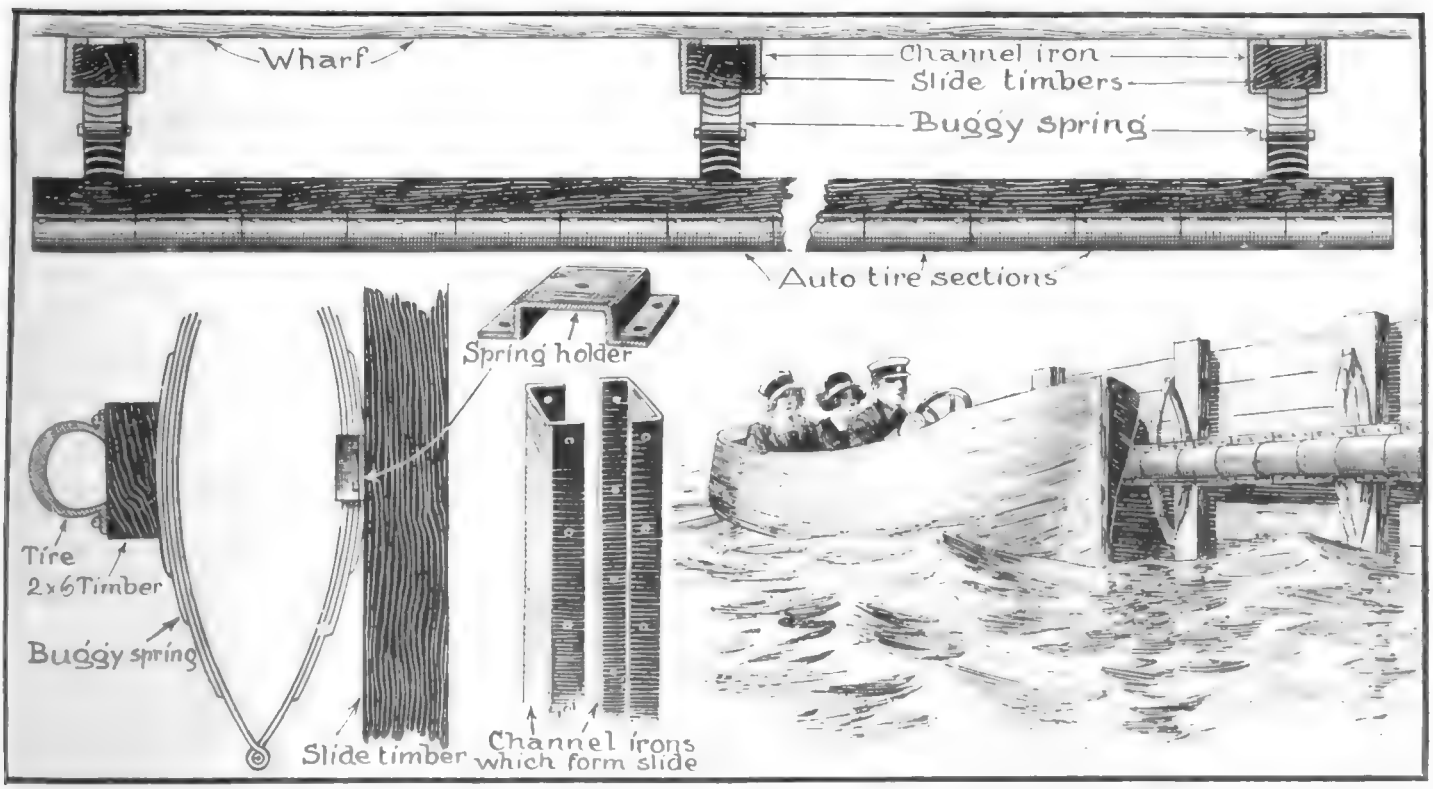


The above photo shows the author whittling the stock of the gun out of soft pine. The diagram at the right will render the construction methods plain. Note that the barrel is secured to the handle by means of two tin straps cut from an old can.

The rear end of the arrow is split, and a feather is inserted after which the end is again glued together. A heavy rubber band acts as the propelling agent for the arrow, which may be accurately fired to a distance of several hundred feet. The upper picture shows the manner in which the arrow is fired, while the lower one shows arrow about to be placed in the pistol.

—Dale R. Van Horn.

Spring Bumper for Boat Landings



The owner of a small boat can provide a means of docking his craft at the home wharf, which will break the shock of landing and save wear and tear on both the boat and the dock. The drawings show a timber padded with auto tire sections, bolted to three light automobile or buggy springs. Each spring, in turn, is bolted to an upright timber which slides in a vertical groove formed by two angle irons which are secured to the dock. The timber floats on or above the surface of the water, depending on the buoyancy of the upright pieces, and thus takes care of the rise and fall of the tide automatically. The tire sections prevent chafing and the springs take up the brunt of the landing impact.—L. B. Robbins.

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Self-propelled Model Airship

Model Following the Lines of Its Counterpart

By C. A. OLDROYD

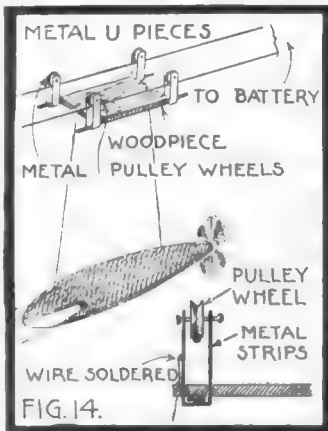


FIG. 14.

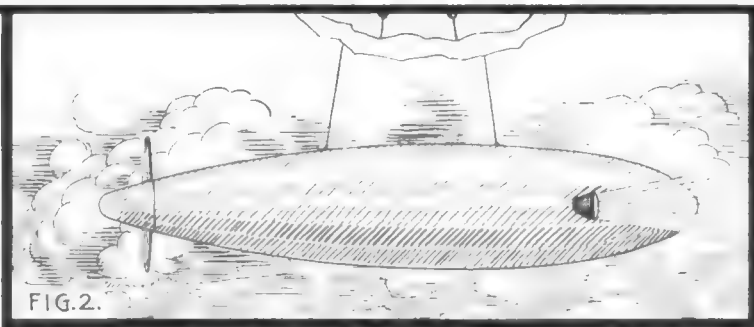


FIG. 2.

A number of model aircraft have been built and described from time to time, but none of them copy very closely the constructional points of the "life sized" craft. The one shown here, however, if built according to specifications given, will follow very closely the structural plans and principles involved in building a regular ship. By suspending it from wires and installing a motor and propeller, aft, a model of its large counterpart will result.

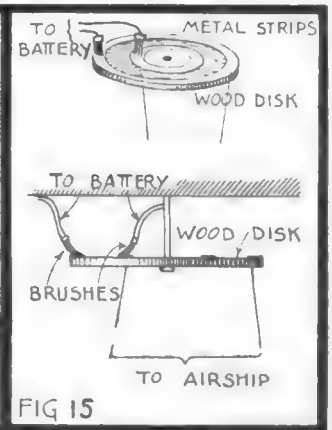


FIG 15

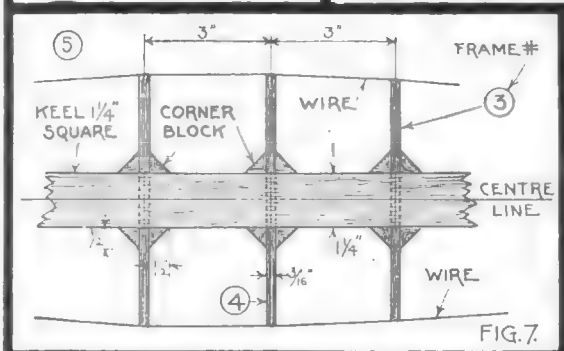


FIG. 7.

At Fig. 7 is shown the method of supporting the ship. The central keel is first to be made and is nothing more than a piece of 1¼-inch square wood stock. From this the various circular supports hold the wires, which in turn hold the cover. The cross supports are held in place by wooden corner blocks, which are glued to them and then to the keel. The total over-all length of the completed model is approximately 30 inches. Below in Fig. 3 is given a line lay-out of the body of the machine. Note that the ship is built entirely from the central base line. In Fig. 14, is shown the method of suspending the model. The wires carry current to the motor.

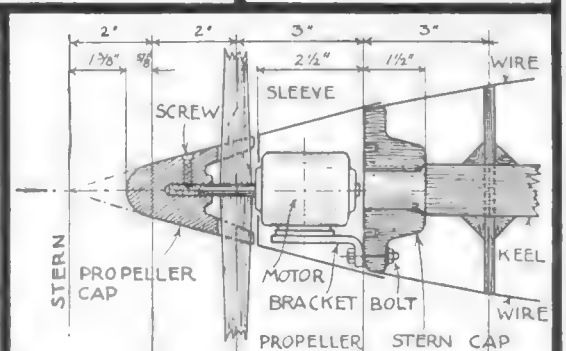


FIG. 10.

Directly below is shown the method of installing the bow cap. It should be turned out of hard wood, according to dimensions given in Fig. 9. It is secured on the bow end of the keel with glue. Complete data on the construction of the keel will be found in Fig. 6. The two ends should preferably be turned. However, if there is no lathe handy, the ends may be whittled down and smoothed off with sand paper. Follow very carefully the dimensions given. In Fig. 12 is shown the dimensions for the construction of the propeller cap.

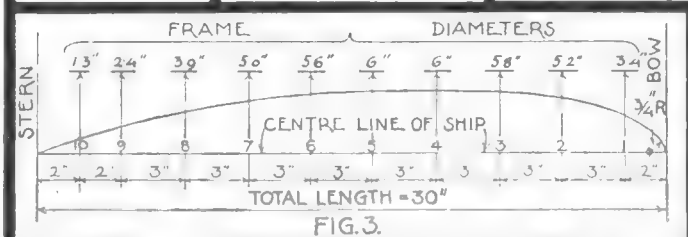


FIG. 3.

Directly above is shown the method of installing the motor and propeller aft of the stern cap. The motor sits on a steel bracket which is bolted to the stern cap. The propeller passes over the motor shaft and is then locked in place by the propeller cap which fastens to the motor shaft by a small set screw. An aluminum sleeve covers the motor after it is put in place. Directly below is shown the lay-out pattern for cutting the cross supports. A cardboard circle is used.

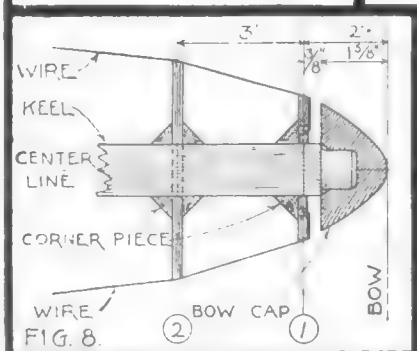
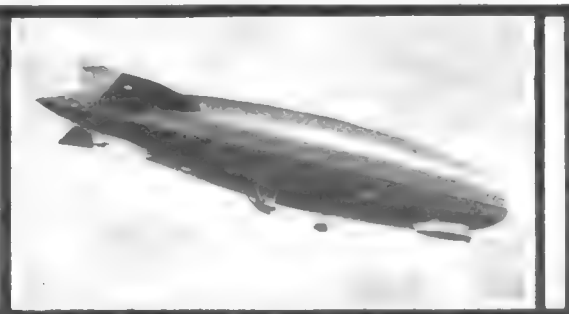


FIG. 8.



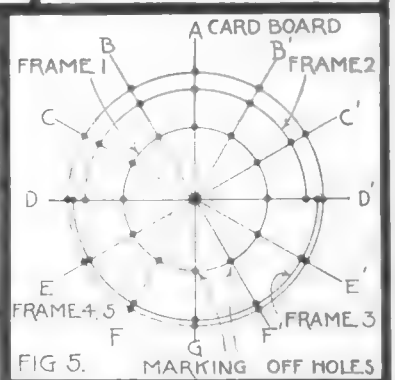


FIG 5. MARKING OFF HOLES

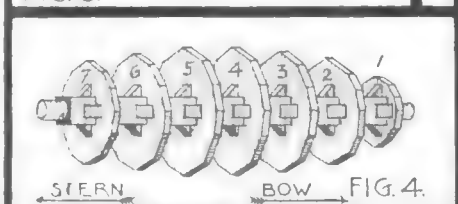
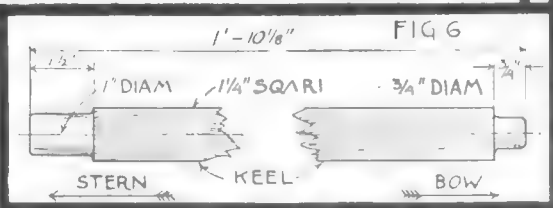


FIG. 4.

Above is shown a view of the completed framework with the different cross supports in place. Note that they are cut in pairs. Each of the cross supports have twelve sides. A wire fits from bow to stern over each one of the corners. They are laid out as shown in Fig. 5 with a cardboard circle, the inside circle marking frame one, the second one frame two, the third one frame three, and the outside ones frames four and five. Six is the same as three, and seven the same as two.



Below is shown the method of binding the wire over the corners of the cross supports.

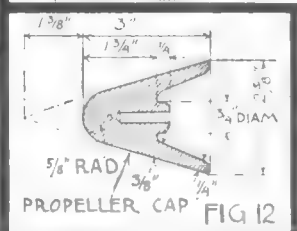


FIG 12

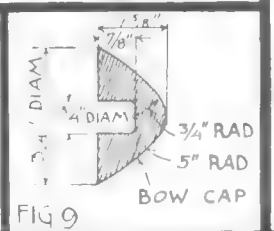


FIG 9

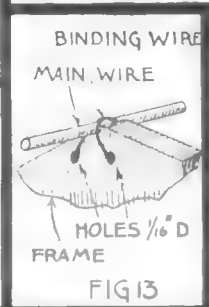


FIG 13

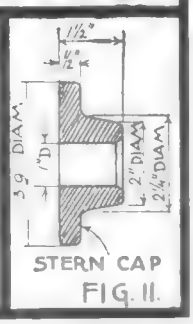


FIG. 11.

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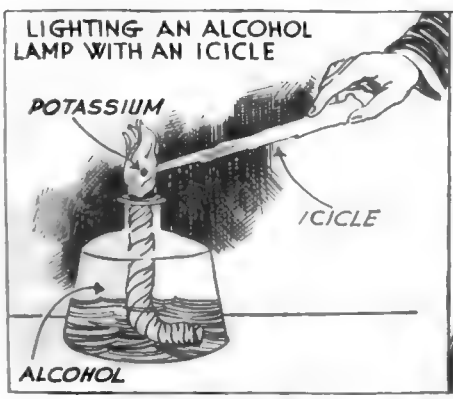
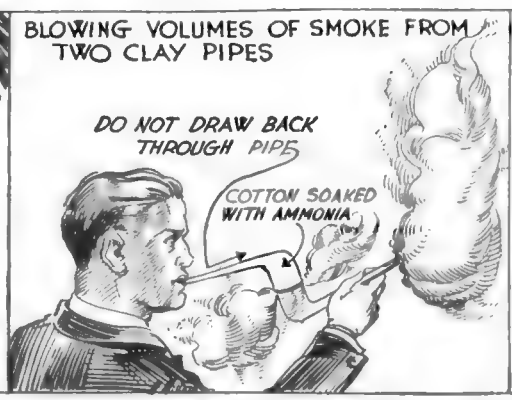
WRINKLES
RECIPES & FORMULAS

Edited by S. GERNSBACK

Chemical Entertainments



To light an alcohol lamp with an icicle place a small piece of metallic potassium on the wick. Touch the potassium with an icicle. The reaction will ignite the wick.

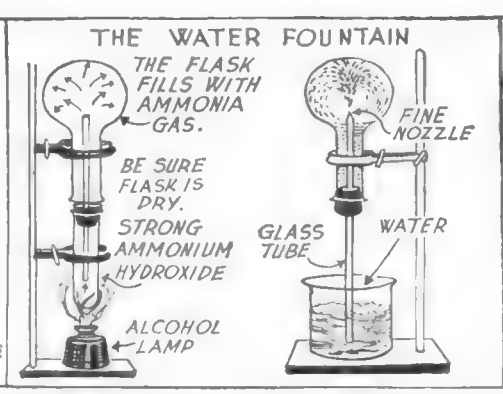


Clouds of dense, white smoke will be produced if a piece of absorbent cotton soaked with strong ammonia is placed in the bottom of one pipe and another piece treated with hydrochloric acid is put in another pipe and blown through.

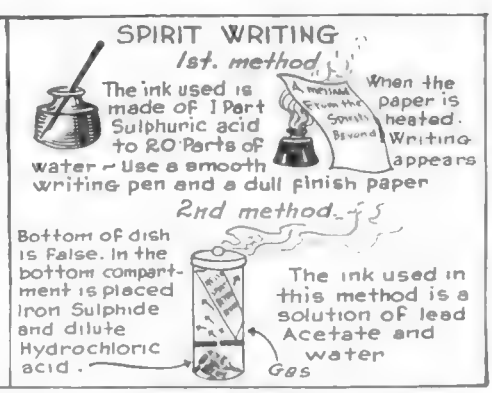
A few drops of sulphuric acid will start a reaction which will result in great fire between a mixture of granulated sugar and potassium chlorate. Keep the flames away from inflammable substances.

MAGIC FIRE-FLUID
Paper takes fire without being touched.
FILTER OR BLOTTING PAPER IS PLACED IN THE SOLUTION TO SOAK IT UP.
The filter paper is placed on the ring of a retort stand and as soon as the Carbon Bisulphide evaporates. Fire occurs
SOLUTION OF PHOSPHOROUS (about the size of a Pea) DISSOLVED IN ABOUT 5 C.C. CARBON BISULPHIDE

Filter paper placed in a solution of phosphorous in carbon bisulphide takes fire spontaneously when the solvent evaporates. Do not handle phosphorous with the fingers.



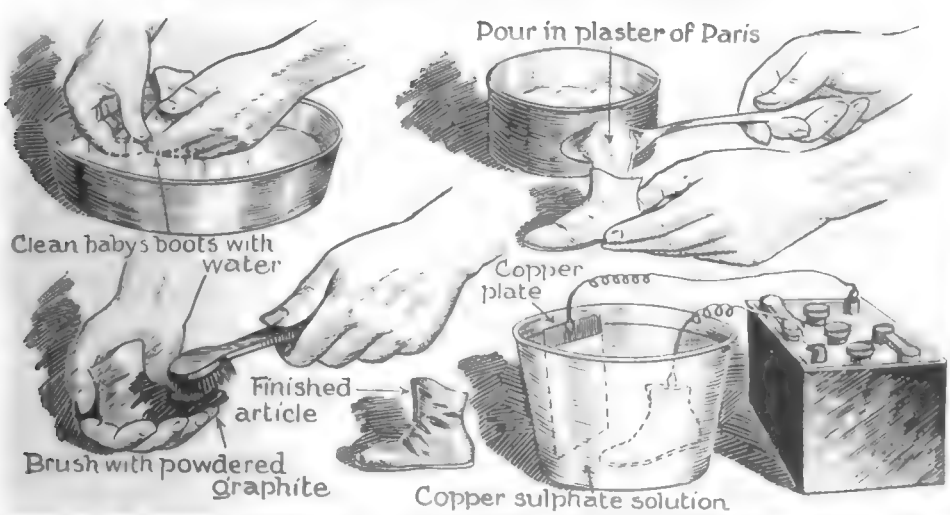
A flask is first filled with ammonia gas in the manner shown. When fitted with a stopper and glass tube, and when the tube is placed under water, a pretty fountain develops.


SPIRIT WRITING
1st. method
The ink used is made of 1 Part Sulphuric acid to 20 Parts of water – use a smooth writing pen and a dull finish paper
When the paper is heated. Writing appears
2nd method
Bottom of dish is False. In the bottom compartment is placed Iron Sulphide and dilute Hydrochloric acid.
The ink used in this method is a solution of lead Acetate and water
Gas

Two simple methods of spirit writing are indicated above. These methods are often used in circus side shows and street fairs.

—Fred W. Dixon.

Electroplate Baby's Boot



Baby's first tiny boots may be transformed into a really useful souvenir in the manner shown above. The boots are first cleaned with warm water, then a thin solution of plaster of Paris is poured into them. All of the aperatures where the plaster might escape must first be lined with stiff paper. If the boots are intended as a letter weight the baby's name and the date of the boots are engraved in the plaster at the opening before the plaster has fully set. The boots are then brushed well with graphite until the whole is covered by a shiny layer. They are then copperplated in the usual manner. If desired, a silver plating can then be deposited on top of the copper.

—C. A. Oldroyd.

Flash Powder

In night photography of birds and animals when the preliminary lighting of a match would frighten the subject away, the following hint may be of value. A hollow is made in the top of a teaspoonful of a mixture of one volume of ammonium chloride and eight volumes of ammonium nitrate. This is filled with zinc dust. The remainder of the pan is covered with flashlight powder. To ignite, touch zinc dust with a drop of water.

—Chas. D. Tenney.

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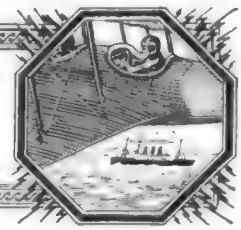
RADIO

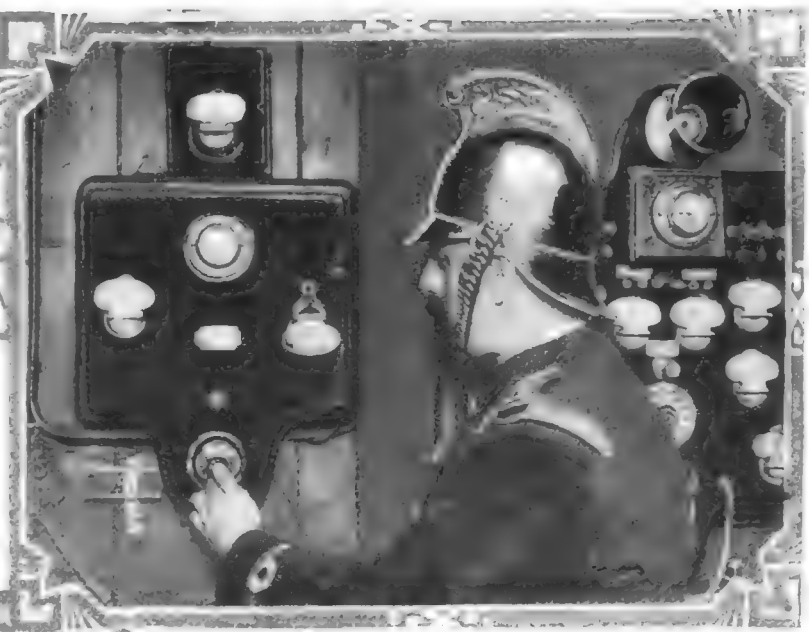


Radio Fire Alarm

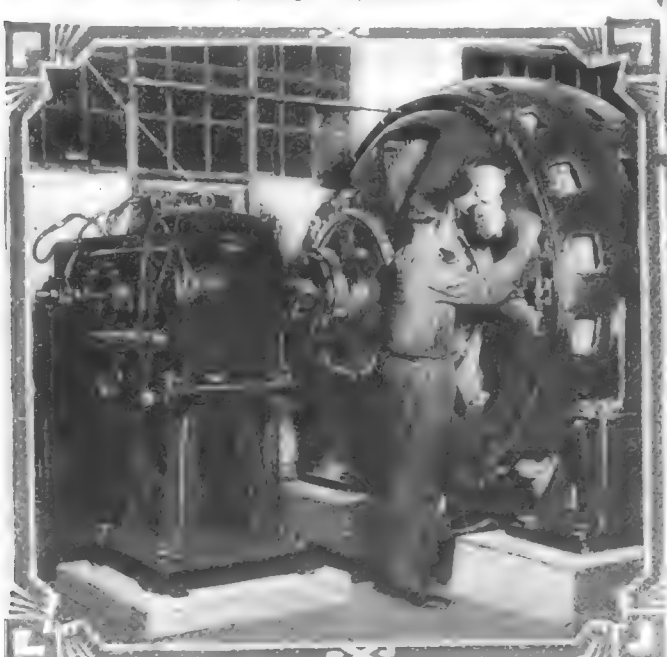
French Transmitter

Latest Radio News from Europe

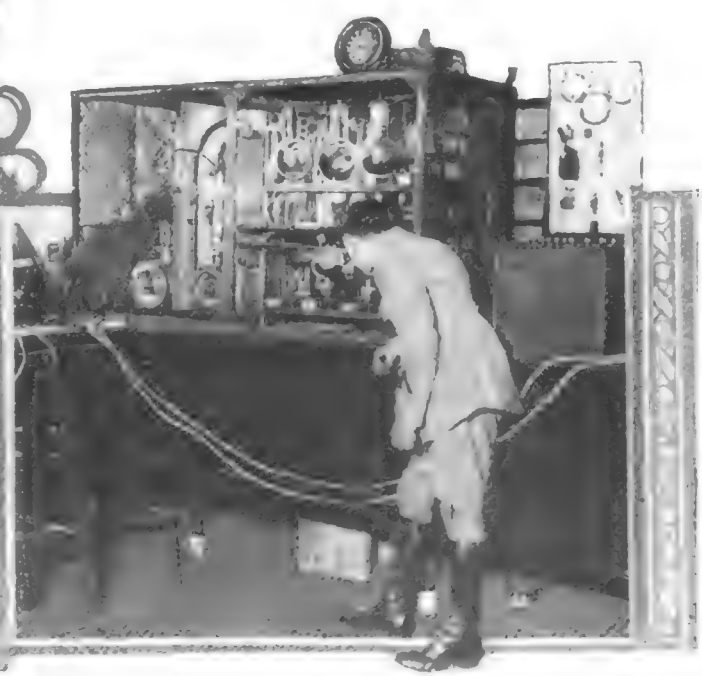
There has been installed in Hanwell, England, a radio fire alarm system which, aside from being 75 per cent cheaper than the ordinary wired type, is, at the same time, very efficient and seldom gives trouble. The photograph directly above shows Chief Officer Ansell sending in an alarm using one of the radio fire alarm boxes. These devices are connected to an electric light cable and to the earth, making a complete circuit.



The photo above shows the receiving and indicating apparatus used in the radio fire alarm system. When the lever in the alarm box is pulled, a pendulum is set swinging within the post. This is electrically operated and affects an indicator in the receiving station which shows the number of the box at which the alarm is entered. Because of the absence of special wires this system can be installed quickly and cheaply.



One of the largest and most powerful radio broadcast stations is located in the Eiffel Tower, Paris, France. The apparatus is almost entirely located in underground passages near the tower from which connections are led to the aerials swinging hundreds of feet above the earth. The photograph directly above shows one of the huge generators which supplies the current for operating the powerful broadcasting apparatus. The passageways in which the apparatus is located extend quite a distance from the tower under Champs de Mars. This apparatus is controlled by the Military Service.



One of the tube cabinets used in connection with the Eiffel Tower broadcasting station is shown above. This is a part of the apparatus that is supplied with current by the generator illustrated at the left. This part of the apparatus, and, in fact, the entire station with the exception of the studio is also located underground. The studio in which the artists, singers, and other entertainers gather is located at ground level, in one of the huge stone bases of the tower itself. The aerial used by this station (1,000 feet high) is the highest in use today. This station has been heard by several United States amateurs.

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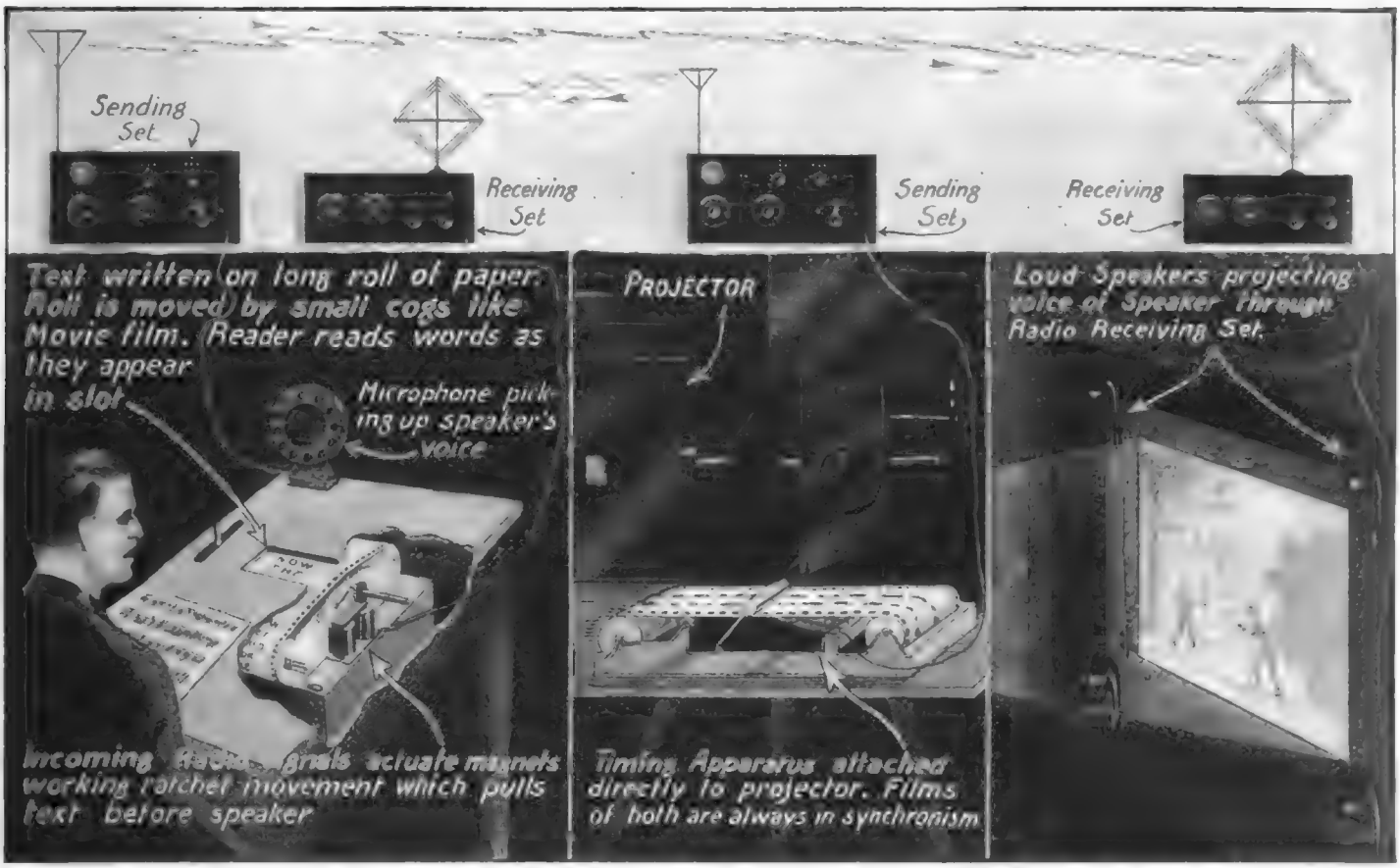
Movie Sub-Titles Via Radio

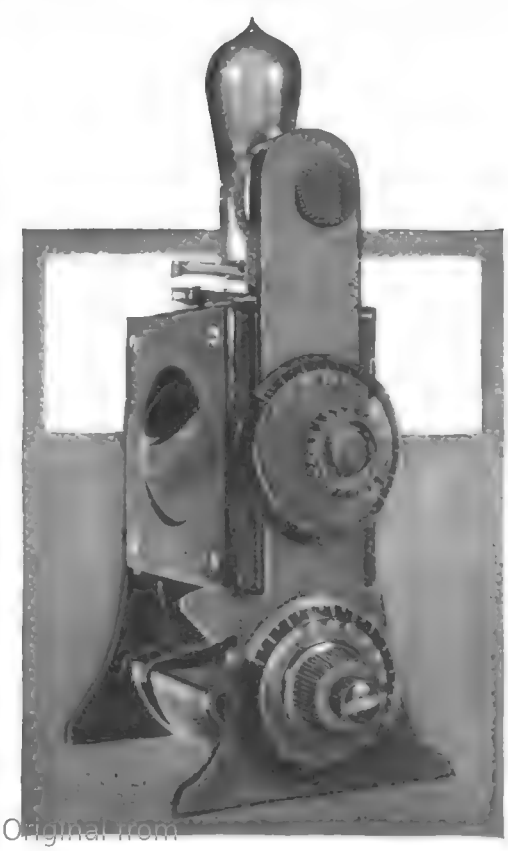

Sending Set
Receiving Set
Sending Set
Receiving Set
Text written on long roll of paper. Roll is moved by small cogs like Movie film. Reader reads words as they appear in slot
Microphone picking up speaker's voice
PROJECTOR
Loud Speakers projecting voice of Speaker through Radio Receiving Set.
Incoming radio signals actuate magnets working ratchet movement which pulls text before speaker
Timing Apparatus attached directly to projector. Films of both are always in synchronism

The device illustrated above is the invention of a French scientist, who hopes to eliminate the motion picture sub-title. By means of a synchronizing device, the text to go with the motion picture is transmitted to a receiving set at the theatre. Here it is reproduced through loud speakers. Another timing apparatus works with the projector and controls the speed of the text roll. This latter synchronization also takes place by radio. Thus two or more theatres may use the sume sub-title reader. —Frederic M. Delano, Jr.

A GENUINE FAN

The photograph at the left shows one of the latest novelties in radio devices. It may readily be called a radio fan as installed on the two outside edges of the fan is a complete radio receiving set. All that is necessary for operation is to connect an aerial and ground and phones to the terminals provided whereupon broadcast programs can be received over a few miles. The device answers two purposes: that of a radio set and of a fan. We wonder how long the detector will stay in adjustment when the fan is used for cooling purposes.

DECORATIVE SET



A radio receiving set using the well known ultra-audion circuit and built in a very unique yet efficient manner is illustrated at the right. This set was built by a full fledged Brooklyn, N. Y., radio amateur. Using only the apparatus shown he has received from stations as far away as Cuba and Nebraska. The builder claims that the set is quite sharp in tuning and can easily cut out local stations. The set, besides serving its original purpose, is built in such a manner that it serves as a decoration also. —Albert Kraus, Rep. No. 8901.

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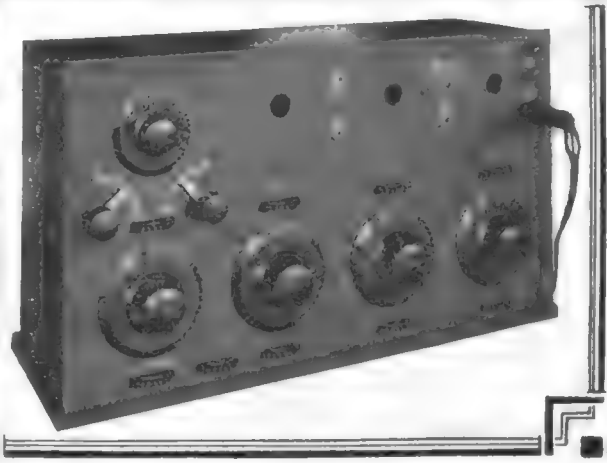
A Three Circuit Tuner De Luxe

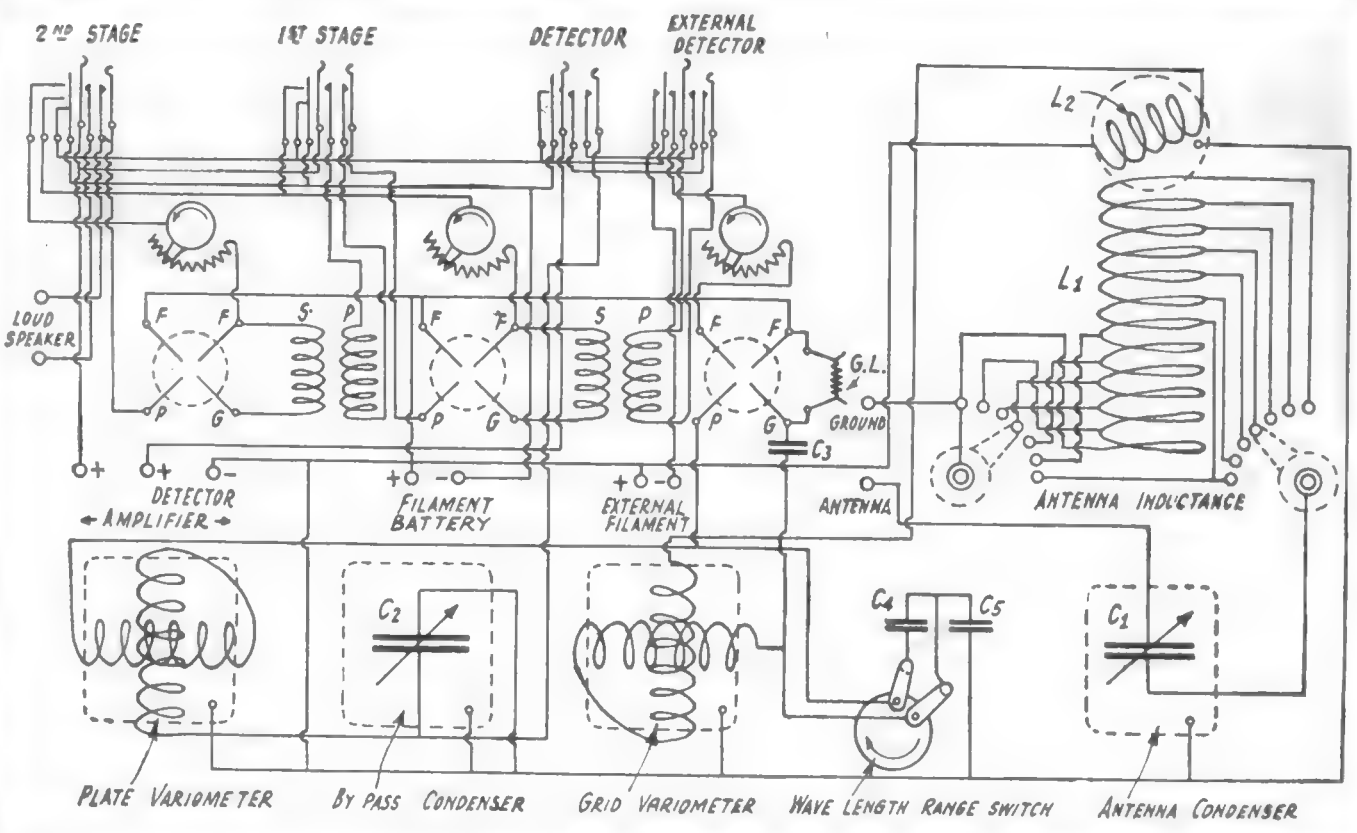
A Tuner and Detector of Exceptional Merit

By L. PORT

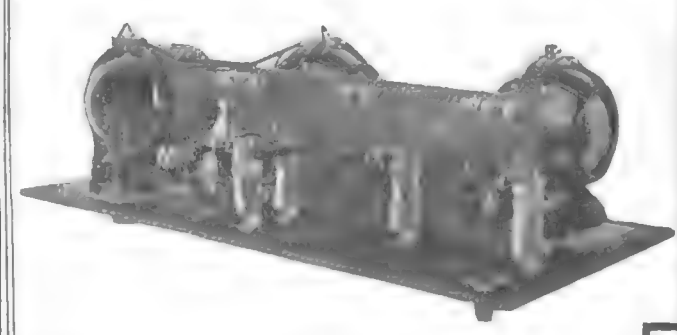


The photograph at the left shows an exterior panel view of the three circuit tuner, a circuit diagram of which is given below. While many other sets have been called the Rolls Royce of radio, so in the writer's estimation this set might well be called the Rolls Royce of three circuit tuners. The panel presents an exceptionally neat appearance, although it is higher than in the average run of receiving sets.

It is made in the double deck style, having the tubes on the upper shelf and four of the five tuning instruments in the lower section. Each dial on the set is equipped with the type of vernier made famous by the manufacturer of this set. The rheostats are of an original design and insead of having a knob and pointer on the front of the panel there is a disc located at right angles to the panel protruding part way through the latter. The edges of the discs are corrugated so as to present a good grip to he operator. Turning the rheostat discs to the left or to the right varies the amount of current supplied to tubes. A separate rheostat is provided for each of the three tubes, for the detector and the two audio frequency amplifiers. The verniers present the same appearance as the rheostats and they are of the frictional type employing rubber wheels. This allows the dial to be turned freely for coarse tuning, whereupon the set can be balanced critically by means of the verniers. As will be seen in the diagram below, a series antenna condenser is used with a vario-coupler stator for the inductance in the antenna circuit. The stator is connected with a grid variometer in the usual manner and a second variable condenser is connected across the primary of the first audio frequency transformer. A variometer is connected in the plate circuit for regeneration. Two small fixed condensers are placed in the circuit and controlled by a unique wave changing switch. The connections of all the instruments can be readily traced out in the circuit diagram given below.



In the three circuit tuner pictured on this page, a diagram of which is given above, provision is made so that if desired for experimental purposes, an external tuner and detector may be used, employing the audio frequency part of the set illustrated herewith for amplification purposes. In this case, the output of the external detector is connected to a standard telephone plug, which is then placed in the jack provided. A second telephone plug is then connected to the receivers and placed in any one of the other three jacks, according to the tube or tubes which it is desired to use. Thus the set can be adapted to either experimental work or it can be once connected up and left in this form for ordinary broadcast reception. The tuner included in this set, which is known as the type CR-6, is capable of covering the entire band of broadcasting wave-lengths effectively. Of course, since two stages of audio frequency amplification are used, the signals received can in most cases be reproduced on a loud talker. Using this set, some exceptional distance records have been made. When one first looks at the interior construction of this set, he is struck immediately with the seeming simplicity and the neat workmanship. Some idea of this can be obtained from the photograph at the right. The tube sockets are accessible for changing tubes when desired or necessary. Every one of the tuning instruments is carefully shielded and the shields connected together so as to reduce any body capacity effect. The shielding is so arranged that the ground binding post makes contact with it, placing at ground potential all of the shields in the entire set. The grid leak is connected from the grid to the filament instead of across the grid condenser, as this position has been found by the manufacturers to be the most efficient. The variometers are of the very latest approved type and instead of having solid molded forms, the forms are constructed of thin strips of insulating material as shown.



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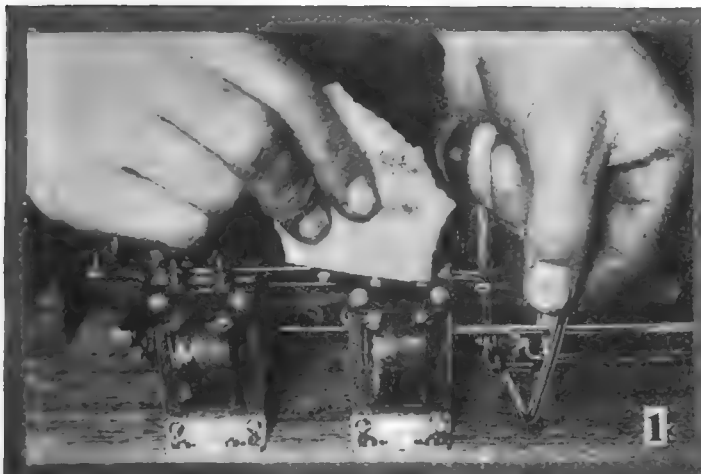
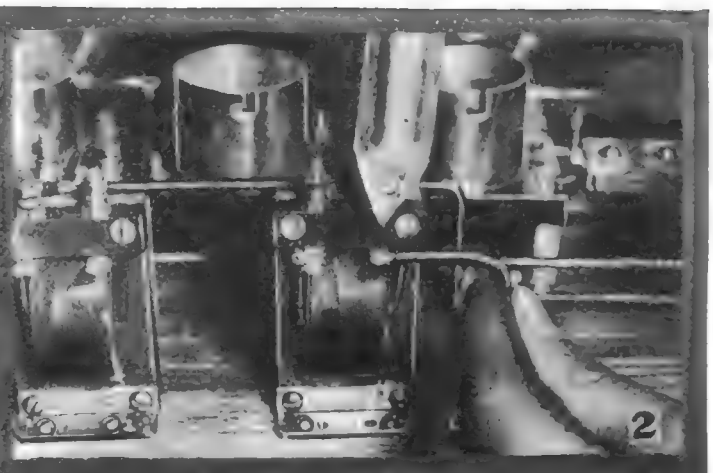
Practical Soldering Hints

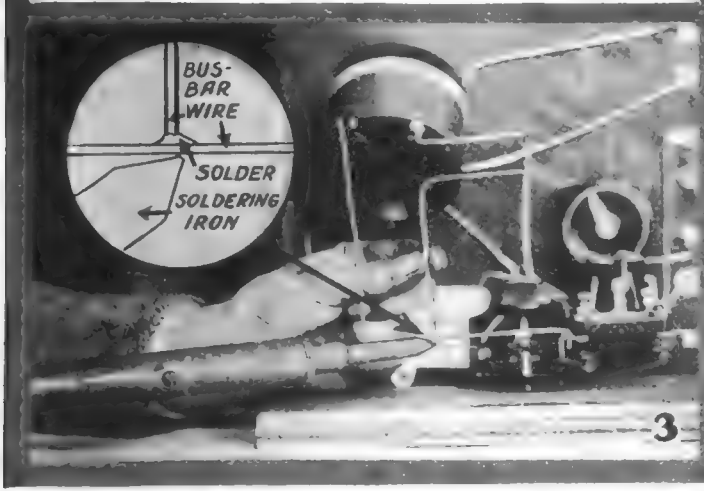
By JACK MILLIGRAM

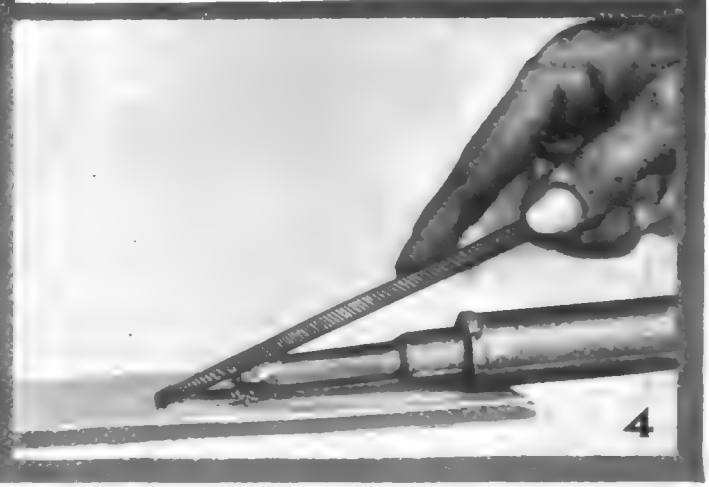


The first thing to remember in connection with soldering is that the points to be joined together must be perfectly clean and free from all foreign substances such as dust and corrosion. Above is shown a method of cleaning the soldering lugs of an amplifying transformer with very fine emery paper. Below is shown the correct method of soldering a right angle joint when bus-bar wire is employed.

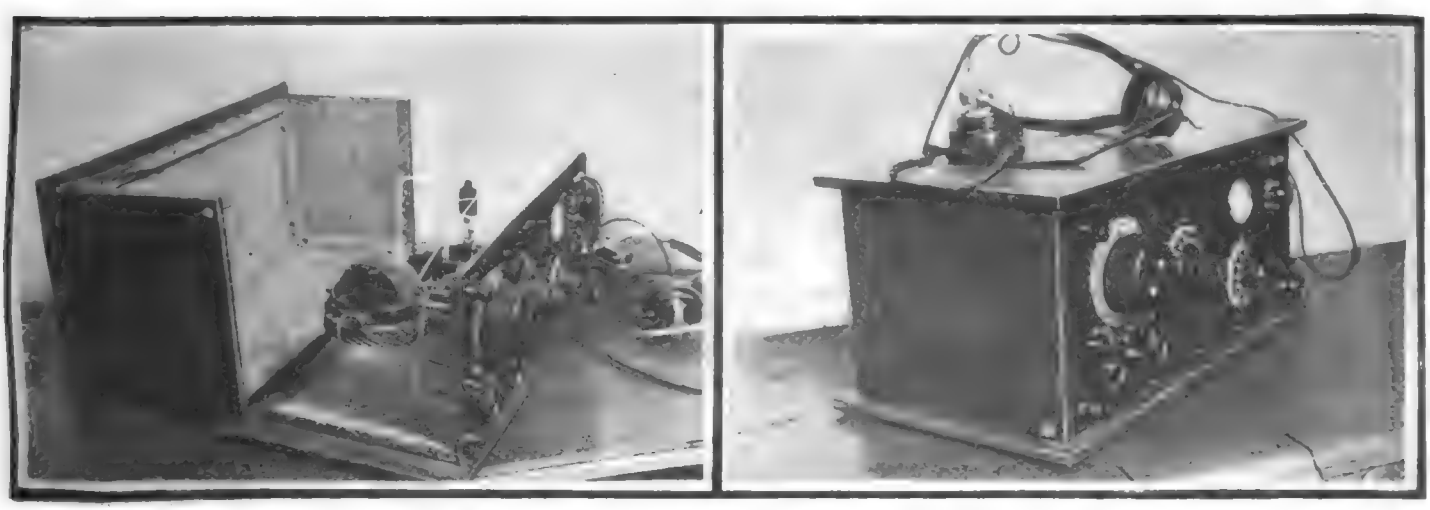


The correct method of soldering to the lug of a transformer is shown above. The wire is placed on the lug after both have been coated with non-corrosive soldering flux. A small amount of solder is collected on the point of the iron and laid on the joint. Hold the iron in position until the solder has run into the joint thoroughly. The best method of cleaning the tip of the iron is shown below wherein a file is employed.





An Improved Radio Cabinet



There are two usual methods of mounting a panel and cabinet so that the instruments can be got at when necessary. One is to have the top of the cabinet hinged so that it may be lifted up and new tubes inserted or repairs made. The other usual method is to mount the panel on a sub-base and fasten the former to the cabinet with only four screws. By removing these screws the entire set can be slipped out of the cabinet. A still better method and one which exposes the entire set is illustrated above. The top and back of the cabinet as well as the two sides are joined rigidly together and hinged to the base as illustrated. Two latches are placed so that the cabinet can be hooked to the base when closed. This makes a neat workmanlike job and one which will be found very handy in many cases. —By Glenn McWilliams.

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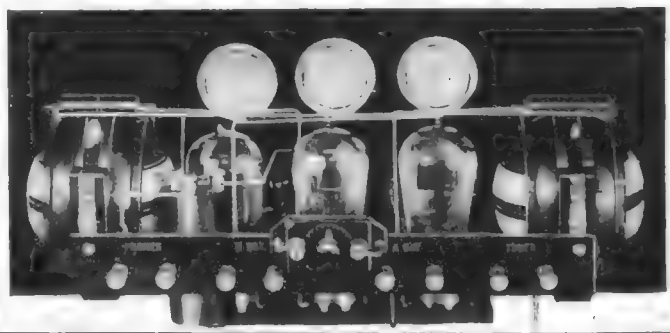
An All Purpose Radio

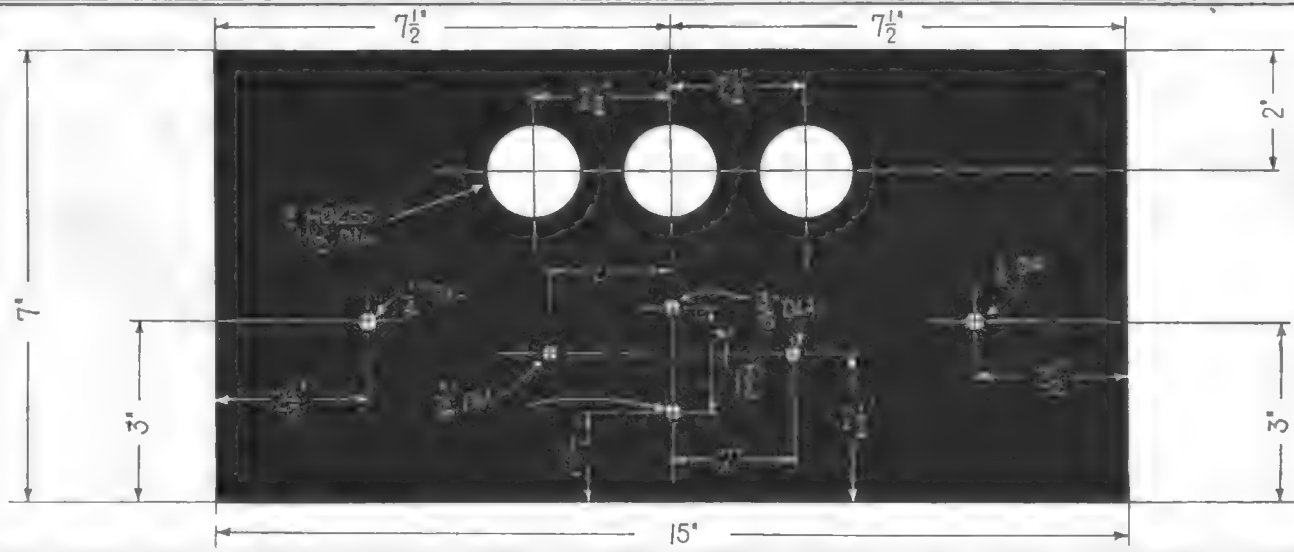
A Three Tube Set Capable

By PAUL

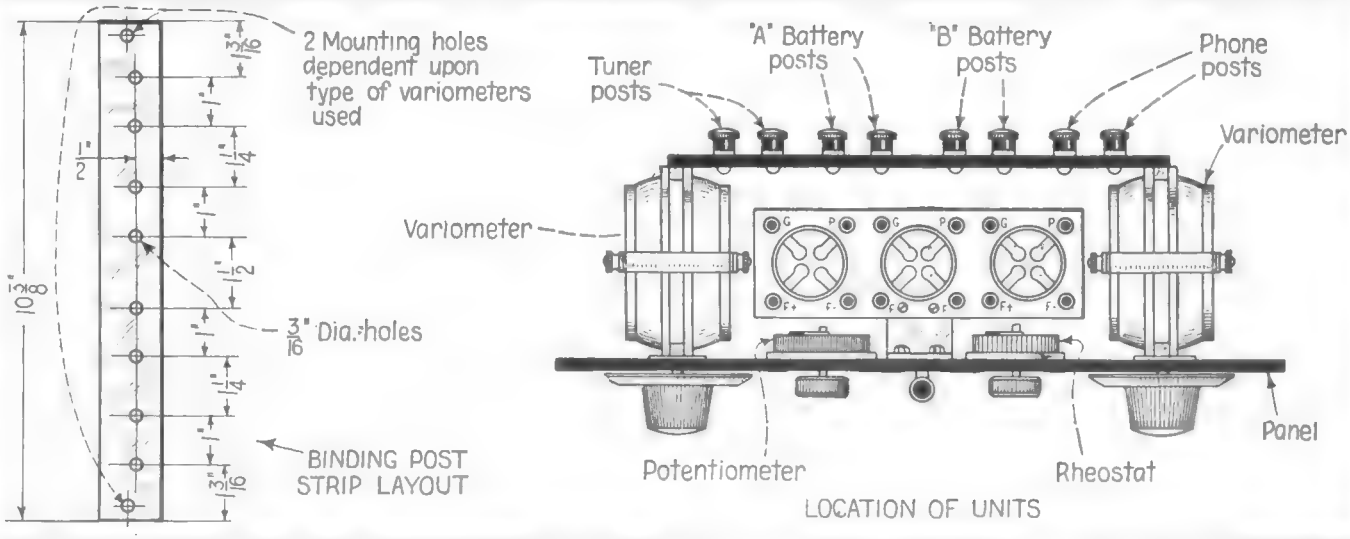
The photographs above and at the right show the front and back views of the extremely efficient radio receiving set designed for the purpose of experimental work. Note the neat and efficient lay-out. The crystal detector mounted between the two knobs on the center of the panel may be of any type desired.



The compact arrangement of the apparatus in this three tube receiving set will be noted above. The terminal strip at the rear supports the variable grid leak and condenser as well as the backs of the two molded variometers. All the terminals are on this strip; connections can be made or changed when required.



Above is shown the panel layout to be used with this set. This plan may be changed to suit the apparatus at hand. However, the general arrangement should be preserved as it makes for short, neat and efficient wiring. The appearance of the front of the panel may be improved by placing nickel plated bezels in the holes provided and placing a piece of fine screen directly in back of the bezels. The holes for mounting the rheostat and potentiometer are shown, although with the majority of apparatus it will be necessary to drill two others to hold the instruments. These can be located after the center hole is drilled. Use a template.



With the particular type of variometers that the writer used, it was possible to fasten the ends of the terminal strip directly to them. Even on variometers where such a provision is not already made, it would be a very simple matter to drill and tap two holes so that machine screws could be used to fasten the terminal strip to the instruments. Note that a three gang socket is used and that a special bracket is made, with which to fasten the sockets to the panel without having recourse to a baseboard. Practically all the instruments can be mounted directly on the panel and the latter fastened into a cabinet in any desired manner.

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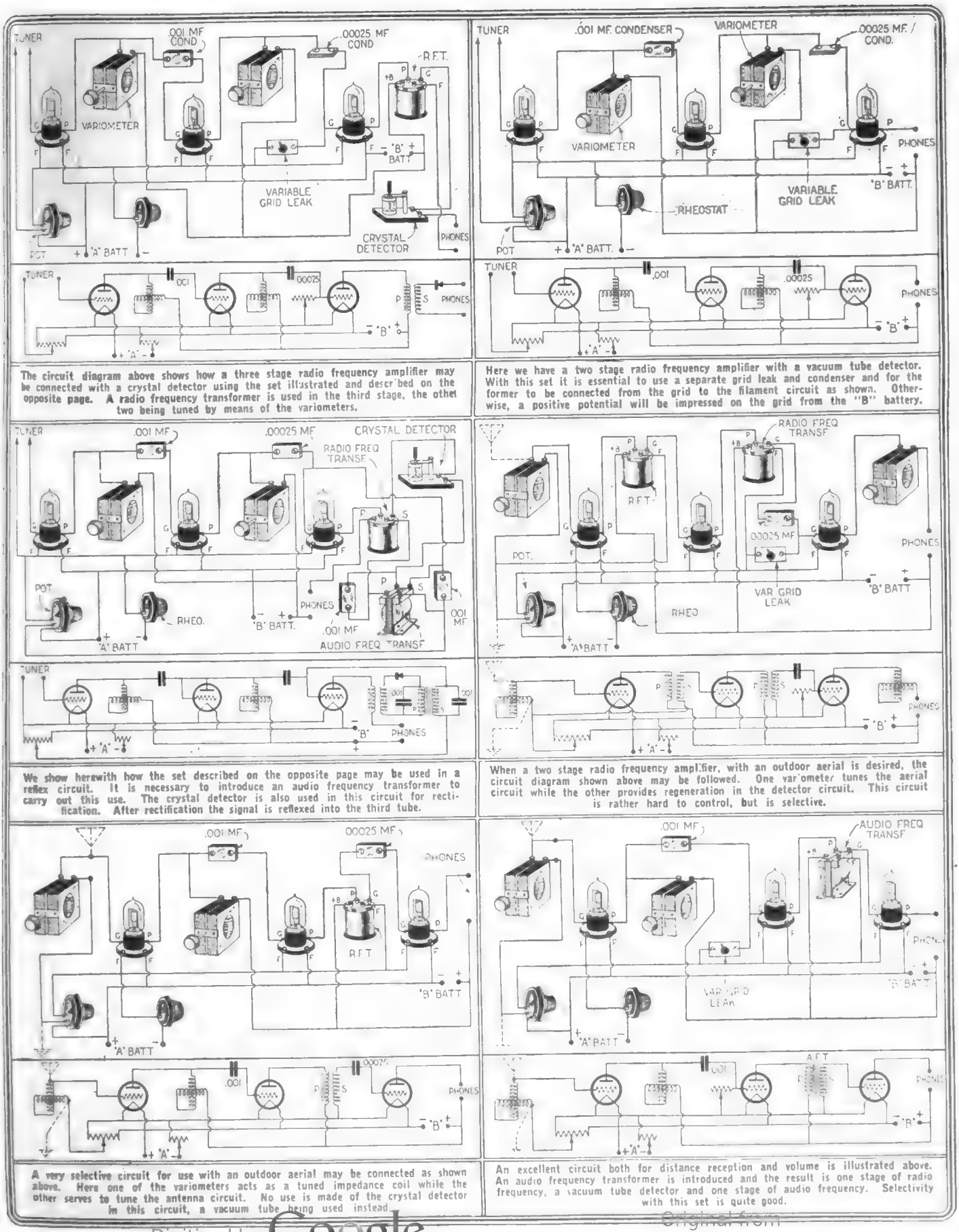
Frequency Amplifier

of Many Changes and Circuits

OARD



The circuit diagram above shows how a three stage radio frequency amplifier may be connected with a crystal detector using the set illustrated and described on the opposite page. A radio frequency transformer is used in the third stage, the other two being tuned by means of the variometers.

Here we have a two stage radio frequency amplifier with a vacuum tube detector. With this set it is essential to use a separate grid leak and condenser and for the former to be connected from the grid to the filament circuit as shown. Otherwise, a positive potential will be impressed on the grid from the "B" battery.

We show herewith how the set described on the opposite page may be used in a reflex circuit. It is necessary to introduce an audio frequency transformer to carry out this use. The crystal detector is also used in this circuit for rectification. After rectification the signal is reflexed into the third tube.

When a two stage radio frequency amplifier, with an outdoor aerial is desired, the circuit diagram shown above may be followed. One variometer tunes the aerial circuit while the other provides regeneration in the detector circuit. This circuit is rather hard to control, but is selective.

A very selective circuit for use with an outdoor aerial may be connected as shown above. Here one of the variometers acts as a tuned impedance coil while the other serves to tune the antenna circuit. No use is made of the crystal detector in this circuit, a vacuum tube being used instead.

An excellent circuit both for distance reception and volume is illustrated above. An audio frequency transformer is introduced and the result is one stage of radio frequency, a vacuum tube detector and one stage of audio frequency. Selectivity with this set is quite good.

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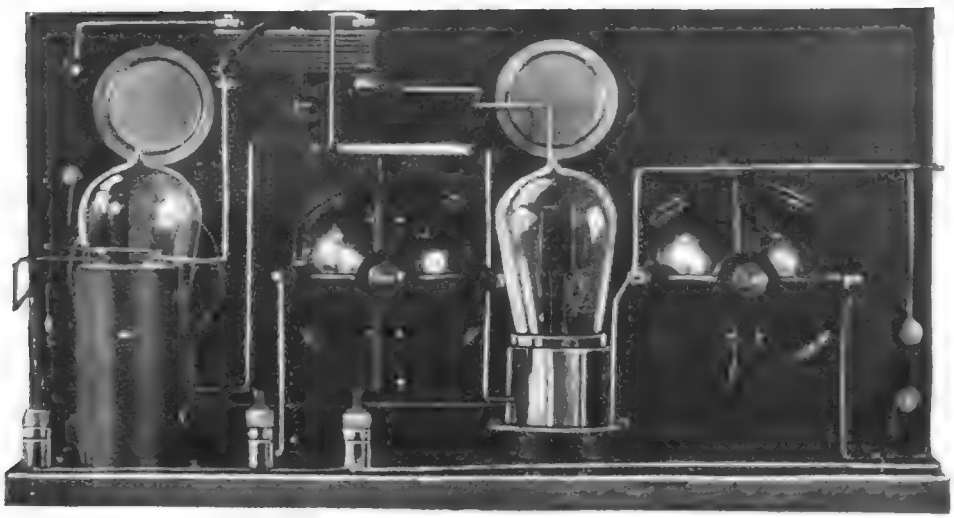
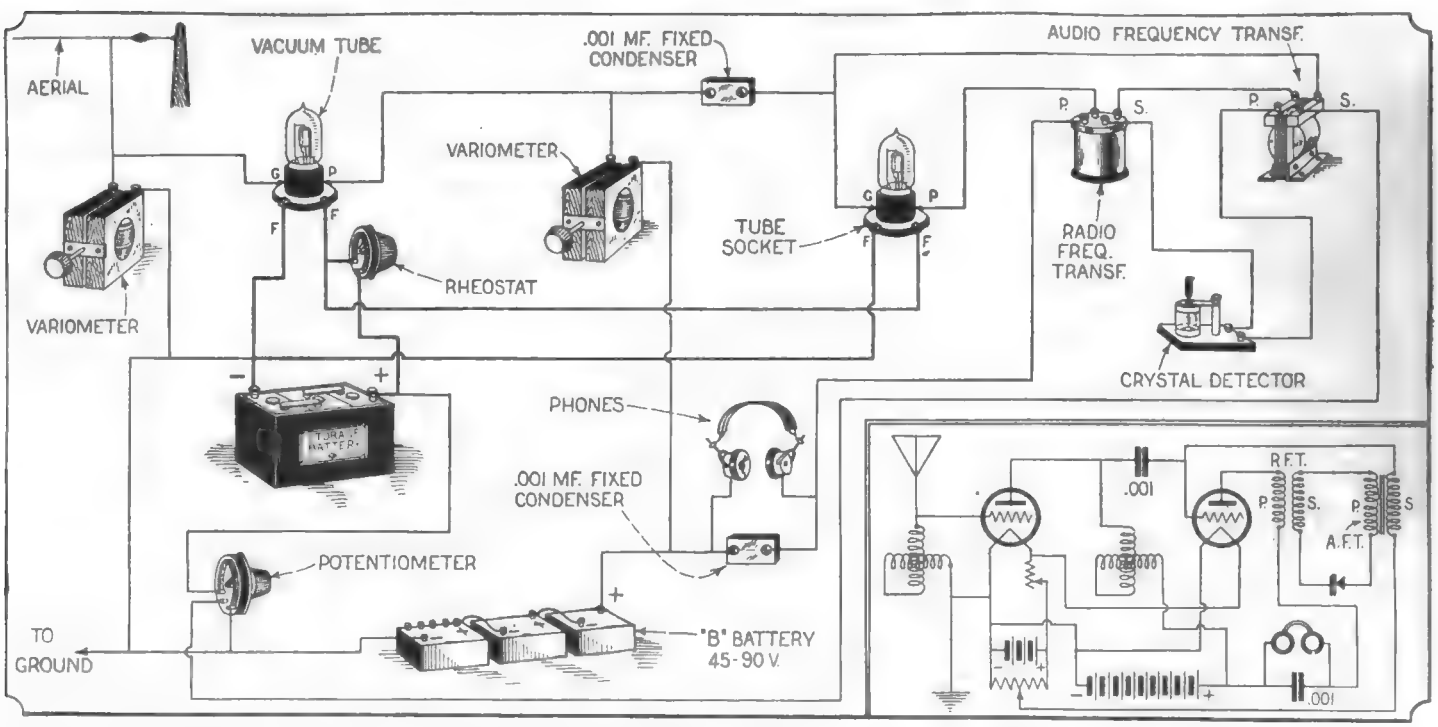
Reflexing Tuned Radio Frequency

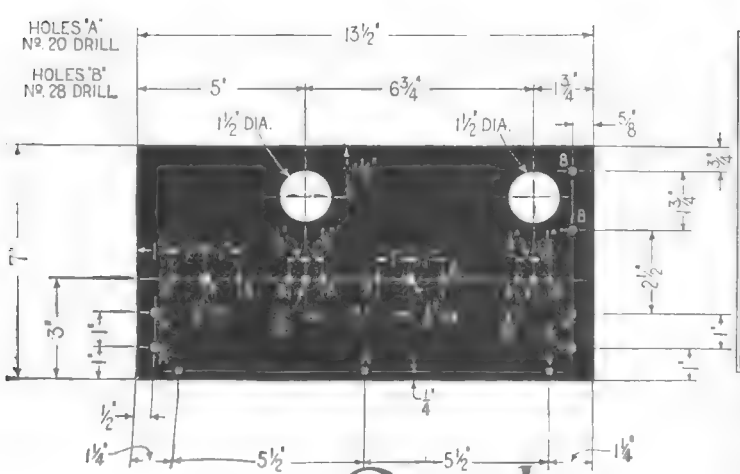
By PAUL OARD

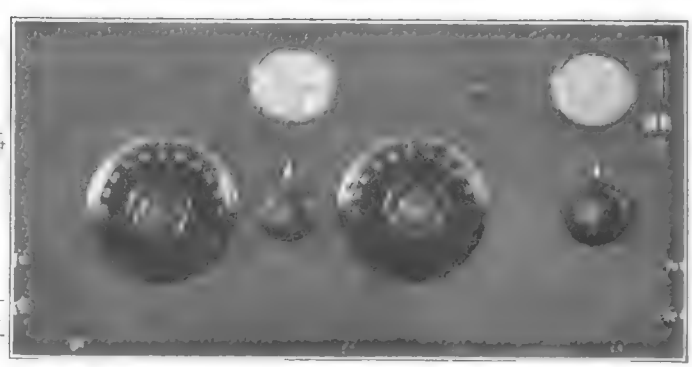


The reflex receiver, constructional data for the building of which is given here, is a two tube affair, utilizing one stage of tuned radio frequency amplification, one stage of transformer coupled radio frequency, and one stage of audio frequency amplification, which steps up the rectified current from the crystal detector. Two variometers form the tuning arrangement of this instrument, one varying the wave-length—the range is approximately 250 to 600 meters — the other being utilized to tune the first radio frequency stage of amplification. This circuit is considered one of the more simple forms of the reflex adaptations. It is comparatively easy to wire, and does not call for an excessive outlay of apparatus. It is quite sharp in tuning, is not difficult to manipulate, and will give an excellent degree of satisfaction whether used on the average outside antenna, or on a 25-foot single wire installed in the operating room. Signal strength sufficient to operate a loud speaker when receiving from a 500 watt broadcast station at a distance up to 1,000 miles is obtained during the evening hours on both types of antenna. The writer advises the use of 201A tubes with this set, although practically any of the standard tubes will give excellent results. Also use the best radio and audio frequency transformers obtainable.



All the necessary connections for hooking up this tuned radio frequency reflex receiver are shown in the diagram above. Note that even though the set is quite selective there are only two major controls. These two controls, when tuning, are to be kept in balance and the set should be tuned with both hands. As the antenna tuning dial is advanced, the radio frequency tuning dial should also be turned through the same space. The knack of keeping these two circuits in resonance can readily be mastered.





At the left is shown the panel lay-out to be used with this receiving set. The reader is advised to make one of these lay-outs in full size and use it as a template for drilling his panel so that accurate results will be obtained. Be sure that the instruments are of the same size as shown or else change the lay-out to suit. The photograph directly above shows the front view of the finished panel.

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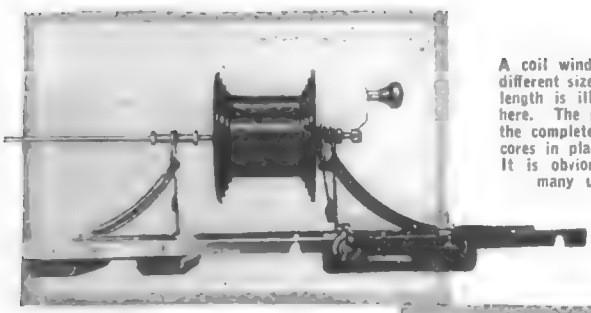
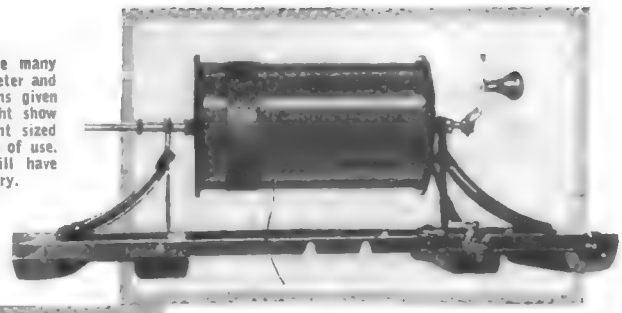
Coil Winder for Radio Work

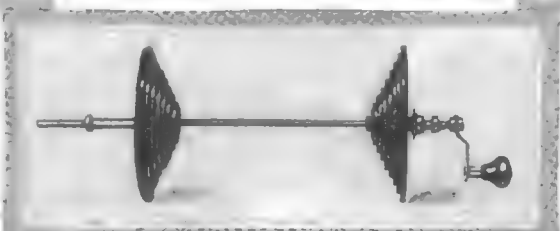
By HERBERT E. HAYDEN



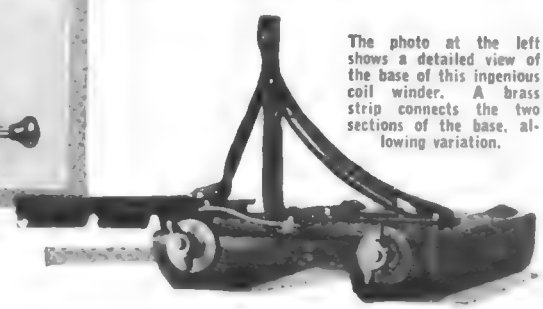
A coil winder which will accommodate many different sizes of tubes both as to diameter and length is illustrated in the photographs given here. The photos at the left and right show the completed winder with two different sized cores in place, illustrating the method of use. It is obvious that this apparatus will have many uses in the radio laboratory.



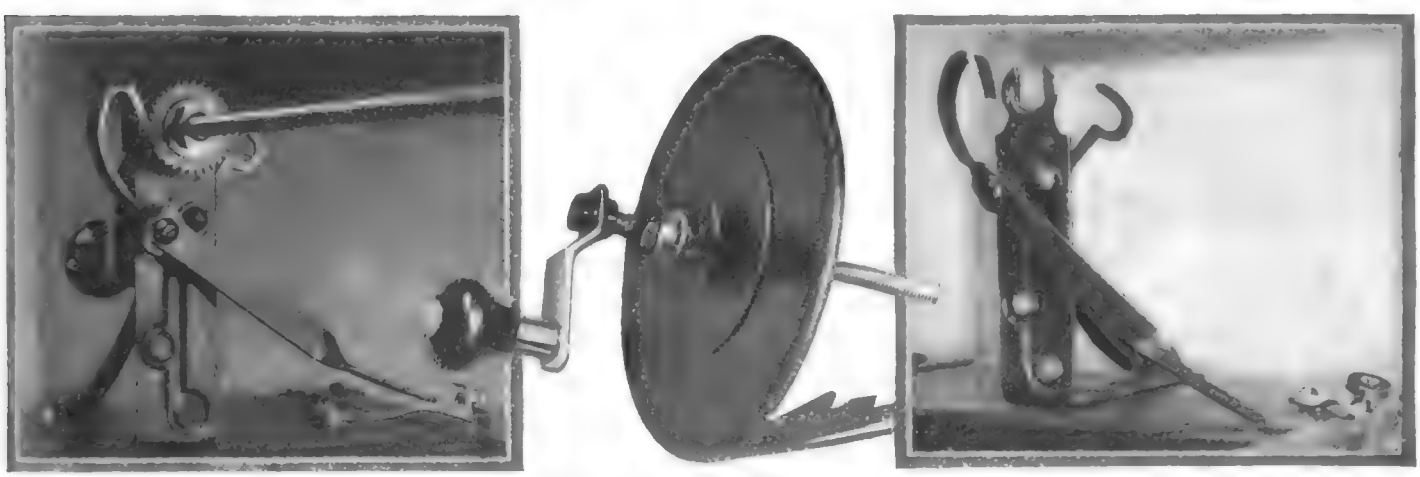
Right: A view of the completed built-up ends of the coil winder. Cardboard or thin wood may be used. It should be thoroughly shellacked.



Above: The ends, shaft and handle of the coil winder completely assembled. Short brass tubes act as bearings.

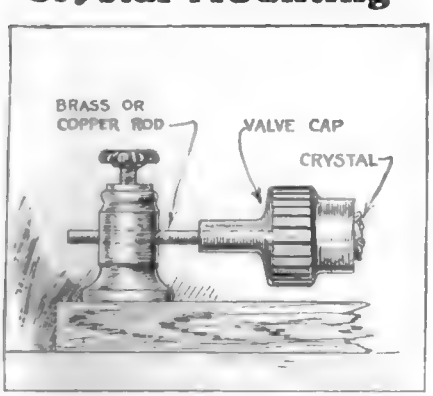


The photo at the left shows a detailed view of the base of this ingenious coil winder. A brass strip connects the two sections of the base, allowing variation.



The supporting ends of this coil winder are two four-inch shelf brackets. The ends are filed out as shown so that the coil can be lifted from the bearings. Small hooks are provided to go over the shaft and hold it in position while winding. The short pieces of brass tubing on the shaft are clamped into the end of the uprights by these hooks. As is shown in the lower center photograph, a small ratchet wheel is clamped to the shaft and to one of the winding ends. A strip of brass bent as shown in the photos at the left and right directly above acts as a pawl. The lower end of this strip is fastened by means of a clip on the base. This prevents the coil from unwinding. The shaft is a 14 inch length of ¼-inch threaded brass rod. The handle is taken from an old hand drill. Wing nuts lock the base in position.

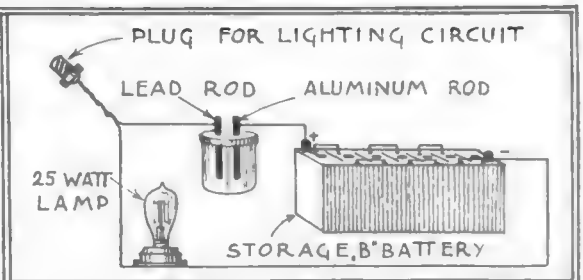
Crystal Mounting



A very neat crystal mounting which permits quick changing of the crystals may be made as shown above. Obtain several valve caps from old inner tubes and mount the crystals in the large end. A short brass rod in the other end forms a support.

—Joseph N. Parker.

Storage "B" Battery Charger



A well known storage battery concern has recently put on the market a small rectifier operating on the electrolytic principle which is designed to charge storage "B" batteries of voltages up to about 60. Higher voltage batteries may be charged in sections. The illustration at the left shows a view of the complete rectifier and above will be seen a circuit for connecting it. Lead and aluminum rods in an alkaline solution give the rectifying action. A lamp is used as a resistance to regulate the charging rate.

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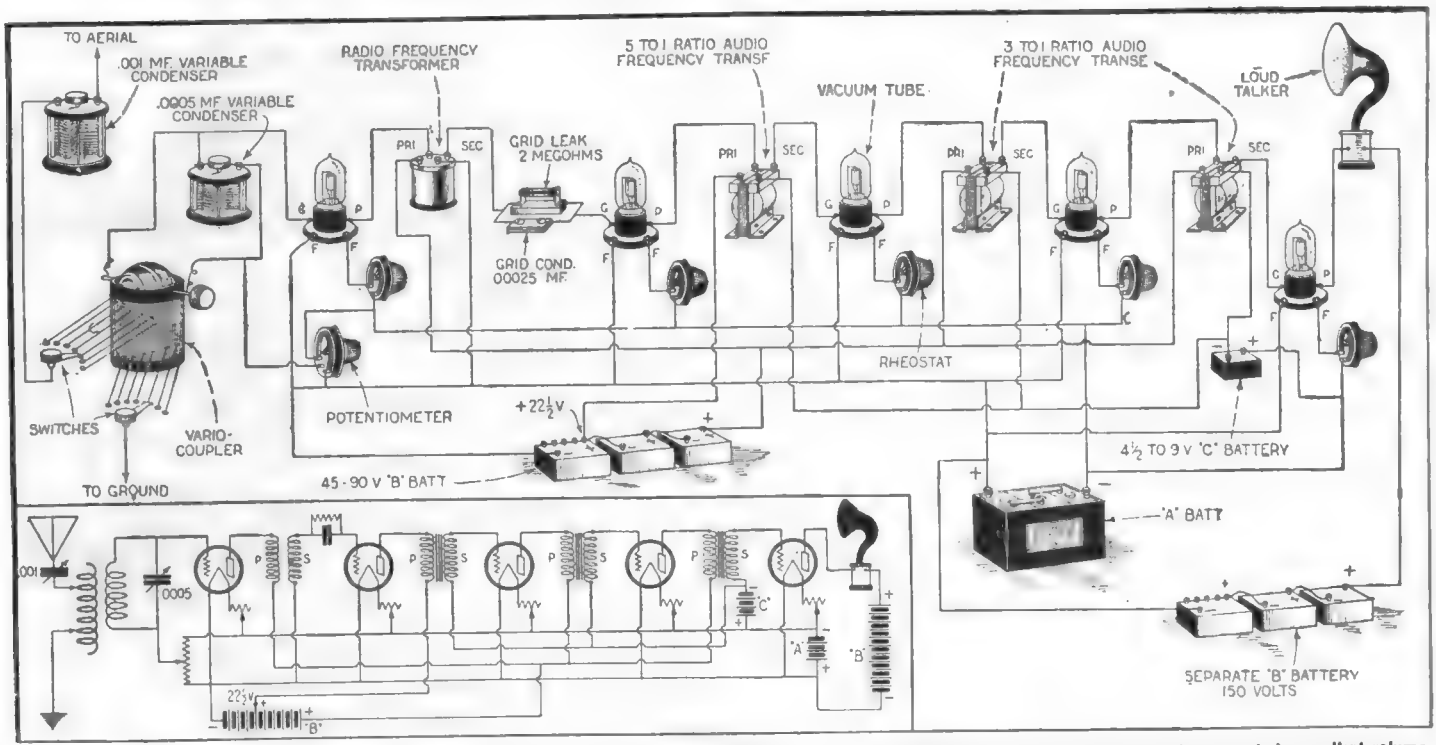
Radio Oracle

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c. is made for all questions where a personal answer is desired.



A good receiving set employing five vacuum tubes is illustrated above both in perspective and schematically. A set of this type will receive over quite long distance and give excellent volume. It is fairly selective, but does not utilize regeneration. Q. 254.

THREE STAGE AUDIO FREQUENCY AMPLIFIER

(254) N. B. Winter, Columbus, Ohio, asks:

Q. 1. Can you give me a circuit diagram for a set using one stage of radio frequency amplification and three of audio frequency amplification so as to operate a loud speaker for a concert hall?

A. 1. We are giving such a circuit diagram herewith. All the necessary information is given on the diagram.

SUPER-REGENERATION

(255) W. H. Gray, La Ceiba, Honduras, wants to know:

Q. 1. Would you recommend the use of an Armstrong super-regenerative receiver using two amplifying tubes for general use, for both "DX" and loud speaker reception?

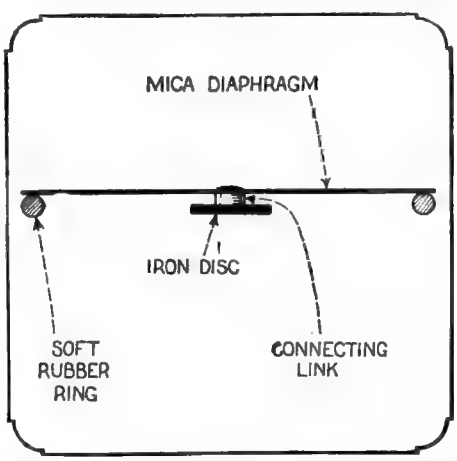
A. 1. Unless you are thoroughly familiar with the theory and practice of radio, we would not advise you to attempt the use of one of the original types of Armstrong's "Supers." We would suggest, however, that instead of the standard super-regenerative circuit you employ that used in the Autoplex which was developed by the Technical Editor of Radio News. This circuit is very simple and gives excellent results. Full information on the Autoplex appeared in the Nov., 1923, issue of Radio News.

Q. 2. What is the voltage per cell of a storage "B" battery?

A. 2. Storage "B" batteries will give a voltage of approximately 2 volts from each cell. A number of cells hooked up in series will give a voltage of two times the number of cells.

MICA DIAPHRAGMS

(256) Erick A. Freeman, Iron Mountain, Mich., submits a sketch showing a proposed diaphragm for use in ordinary receivers which consists of a mica disk to the center of which is attached a small soft iron disk.



Mica diaphragms are now being manufactured which can be attached to standard receivers. The design of these diaphragms is illustrated above. Q. 256.

An illustration of the proposed idea is given herewith. He asks:

Q. 1. Do you consider this idea to be feasible?

A. 1. The suggestion you make is very good and will give excellent results, but it is already patented and the diaphragms are being marketed by a New York concern.

RECEIVING RANGE

(257) H. Cooper, Brooklyn, New York, submits a circuit diagram of a tuner employing tickler feed-back used in connection with a detector and two stages of audio frequency amplification. He asks:

Q. 1. Should I be able to receive from Chicago with this set, and how can I increase the selectivity of the same?

A. 1. Although we do not make a practice of giving the exact receiving ranges of sets, as this is impossible, still we would say that with the set you have you should have no trouble in receiving such stations as Chicago, Atlanta, etc., providing you are listening at the correct time and your set is properly tuned. The selectivity could be increased by inserting a variometer in series with the plate and the tickler coil, or in series with the tickler coil and the jack. Try both connections to determine which gives best results.

OSCILLATION

(258) J. A. Clifton, Conway, S. C., requests:

Q. 1. In radio reception, are the tubes used to be kept in oscillation or not?

A. 1. In radio telephony, work, when the tubes in the set begin to oscillate whether it be the radio frequency, detector or audio frequency, reception becomes practically impossible or at least the signals are so distorted as to be unreadable. In transmitting, the tubes are always kept in oscillation. In receiving, the trick is to keep the detector tube as near the oscillating point as possible without allowing it to break into oscillation for at this point reception is at its best.

WANTED!!! RADIO ARTICLES

We want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We want articles on the latest single tube receptors which require a minimum current from the filament battery.—Editor.

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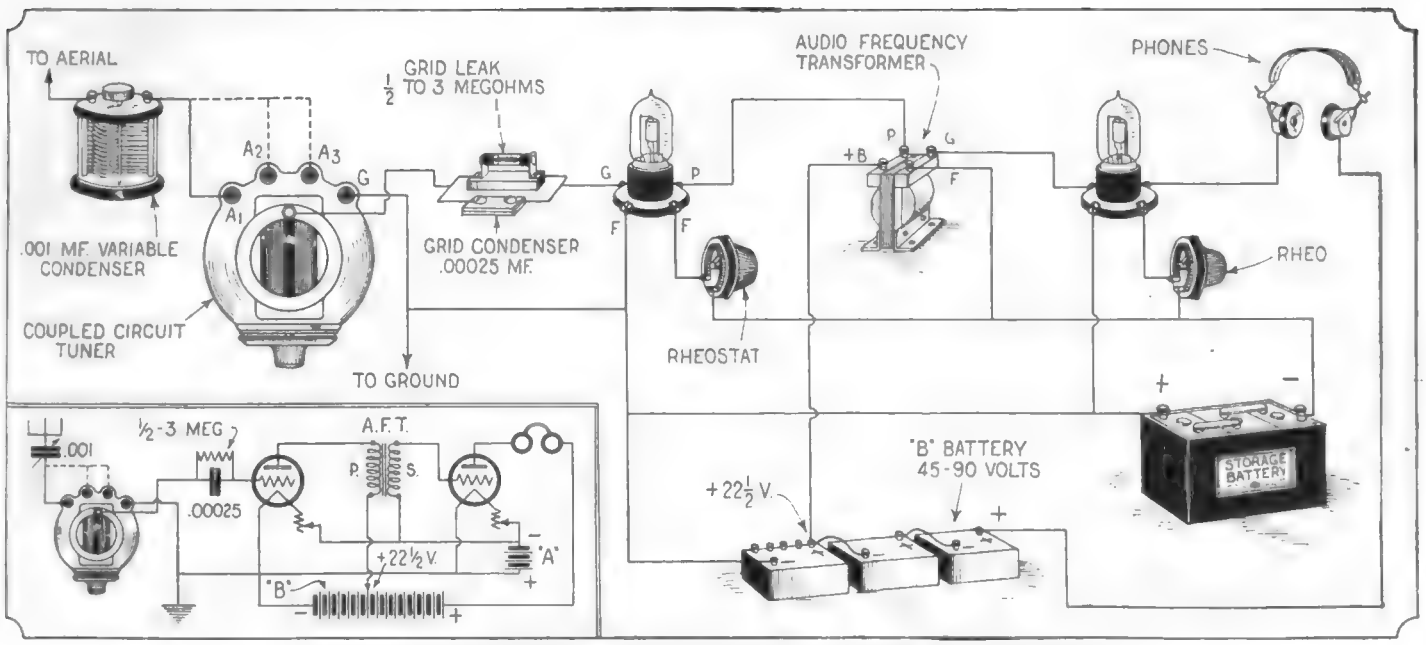


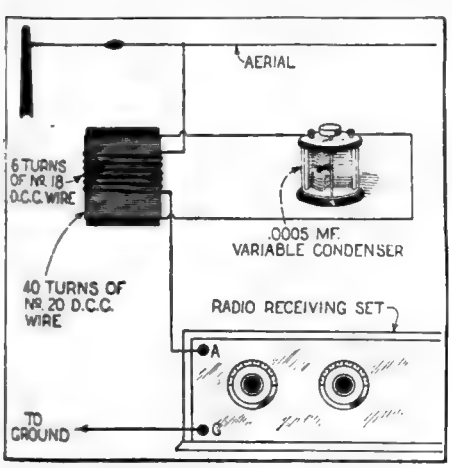
Q. 260. A very compact receiving set may be made by using the tuner illustrated above and connecting the instruments as shown. Fairly good volume will be obtained with a minimum number of instruments.

WAVE-TRAP

(259) Harry F. Holland, Philadelphia, Penna., sends us a circuit diagram of a certain type of set and says that he has trouble in tuning out local stations with it. He asks:

Q. 1. Can you suggest some type of set which will eliminate this trouble or tell me what to do with my present set?

A. 1. The circuit you mention is not noted for its great selectivity and we do not wonder at the trouble you have had in trying to tune out the local stations. The circuit seems to be O.K. as it must be if the local stations come in good. We would suggest that if you want a really good set, you buy or construct one of the neutrodyne type, using either three tubes for satisfactory phone reception or five tubes for loud speaker reception. Otherwise, use a wave trap, the construction and circuit of which is given herewith.



Q. 259. If your receiving set does not tune sharply, try using a wave-trap such as illustrated above.

COUPLED CIRCUIT TUNER

(260) George W. Driscoll, Erie, Penn., asks:

Q. 1. Can you tell me how to hook up one of the so-called coupled circuit tuners with a straight, vacuum-tube detector and one stage of audio frequency amplification?

A. 1. The circuit diagram for this work will be found in these columns.

FLEWELLING CIRCUIT

(261) Jack Casey, Falfurrias, Texas, asks:

Q. 1. Can you refer me to an article which describes the connections of the Flewelling circuit both with the detector and with the two stage amplifier?

A. 1. We would refer you to the Radio Oracle Department of the May, 1923, issue of this magazine. This item contained full and complete data on the construction of the Flewelling circuit as well as showing the method of adding audio frequency amplification to the same.

FIXED COUPLER

(262) Guy Hayes, Tinley Park, Ill., requests:

Q. 1. What is meant by the term fixed coupler?

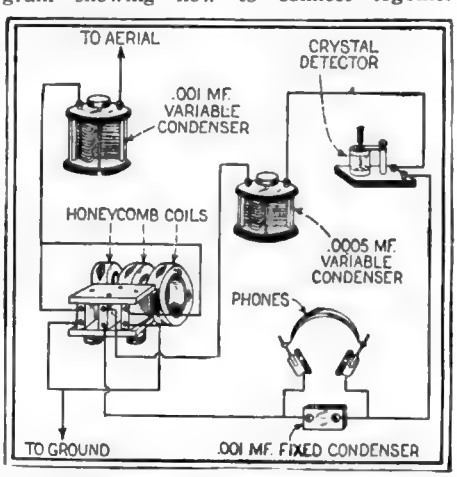
A. 1. The term fixed coupler is applied in general to two different types of instruments. The first is that in which a rewound vario-coupler is used. The stator has no taps made upon it and its wavelength range is controlled by a variable condenser. The primary is of the so-called untuned type and consists of a comparatively few turns of heavy wire wound directly over the stator or along side of it. Within this type of coupler is contained a rotor which is used as a tickler.

The other type of fixed coupler is that in which no adjustments are made on the coupler itself. The relationship between the primary, secondary and tickler is fixed continually and an aperiodic or untuned primary is used. The amount of regeneration is always the same.

HONEYCOMB COIL SET

(263) Edgar Leuthold, Woodcliff, N. J., asks:

Q. 1. Can you give me a circuit diagram showing how to connect together three honeycomb coils and a crystal detector using two variable condensers?



Q. 263. Honeycomb coils give excellent results with a crystal detector. Three coils may be connected as shown.

A. 1. Here is diagram requested.

200 ILLUSTRATIONS—100 ARTICLES

is the average of every issue of RADIO NEWS. We doubt if there is a radio magazine in print that can show the diversity of articles and illustrations that is found in this magazine.

But above all, it is the quality of the material that is of prime importance to the man interested in radio. RADIO NEWS appeals to all factions; the Scientist, the Amateur, the Experimenter, the Broadcast Listener, and the Manufacturer. Each will find articles written especially for him. Every issue of RADIO NEWS is a radio education by itself. Sold on 35,000 newsstands in the United States and in every international book store in every civilized country the world over.

A LIST OF INTERESTING ARTICLES APPEARING IN THE JUNE ISSUE OF RADIO NEWS

Radio Broadcasting in Great Britain. By Dr. J. A. Fleming.

The History of Radio.

New Army Control Station at Fort Leavenworth. Capt. R. B. Woolverton.

The Radio Receiver in Camp. By W. Palmer Powers.

Detecting Music with Nitrogen Tube. By B. G. Bazzoni.

The Vacuum Tube and How It Works. By Prof. John H. Morecroft.

Hints on Receiving Sets. By Louis Frank.

The Reinartz All-Wave Tuner. By John L. Reinartz.

A Resistance Coupled Amplifier. By Clyde J. Fitch.

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Awards of $1000 Monthly Prizes

The Regular Departments Pay Prizes of Their Own. Authors on Contract Receive Their Own Rates; Making the Total Paid for Articles in Excess of $1500.00 Monthly.

FIRST PRIZE $100.00

Charles T. Dahama 126-127

TWO PRIZES OF $50.00 EACH

Dr. Russel G. Harris, Harvard University 137
O. Ivan Lee, B.Sc., F. M. S. A. 158

TEN PRIZES OF $25.00 EACH

N. Wright, Rept. No. 7211 125
Charles T. Dahama 136
George Holmes 138
Raymond Francis Yates 141
Jos. P. Devir 150
G. M. Garrard 150
C. A. Oldroyd 160
O. Ivan Lee, B.Sc., F. M. S. A. 161
Paul Oard 168-169
Paul Oard 170

FIVE PRIZES OF $20.00 EACH

R. G. Thackwell 124
Ismar Ginsberg, B.Sc. 148
Raymond Oriol 152
Dale R. Van Horn 159
Herbert E. Hayden 171

TEN PRIZES OF $15.00 EACH

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T. J. Cox 143
P. Henricksen 143
Paul L. Clark 149
Raymond Francis Yates 149
James Thomas 151
L. B. Robbins 159
O. Ivan Lee, B.Sc. 161
Fred W. Dixon 163
Frederick M. Delano 165

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Phil Gersdorf 148
R. Kemp Welsh 152
Dr. Albert Neuburger 153
Ismar Ginsberg, B.Sc. 153
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W. J. Markowski 162
Sam Colson, Rept. No. 3888 162
Lester O. Eten 162
C. A. Oldroyd 163
Albert Kraus, Rept. No. 8901 165
Glenn McWilliams 167
L. B. Robbins 193
F. W. Kurth (Please send address) 195
Ralph E. McAdam 207
Walter T. Markowski 207
Mahlon Adams 208
Madison Walraven 208
W. R. Adams 209
H. F. Loeffler 210
George W. Moore 210

TEN PRIZES OF $5.00 EACH

Chas. D. Tenney 163
Joseph N. Parker 171
Leroy Western, Rept. No. 15 209

(*Balance—7 Prizes* $5.00 *Each—No Entries*)

TWENTY PRIZES OF $2.00 EACH

(*No Entries*)

TEN PRIZES $1.00 EACH

(*No Entries*)

Here Is How You Can Get in the Contest:

$12,000 or More in Gold

EVERY month SCIENCE AND INVENTION pays $1,000 or more in gold in prizes. Every text article published will receive a prize—(most of the departments have awards of their own which they give every month). Ideas are what the Editors want. The ideas must be told simply, so that your mother or your sister can understand them—in pictures or sketches or both. But the idea must be new and must have something to do with science or invention.

The Editors want pictures and sketches—must have them—but what they want most is IDEAS. These ideas will be handsomely paid for. We have published a pamphlet showing the rules of the contest which we shall be glad to send to anyone free on receipt of a postal card with your name and address. The pamphlet gives full details, the rules and how to submit articles. The magazine itself shows you what is wanted. Study it closely and submit your ideas.

The closing date for all prize contributions is the 15th of the month preceding date of issue, *i.e.*, the 15th of June for the Aug. issue, the 15th of July for the Sept. issue, etc.

88 monthly prizes will be given as follows:

FIRST PRIZE			$100.00	
2	PRIZES	of	$50.00	each
10	"	"	25.00	"
5	"	"	20.00	"
10	"	"	15.00	"
20	"	"	10.00	"
10	"	"	5.00	"
20	"	"	2.00	"
10	"	"	1.00	"

$12,000 or More in Gold

WILL YOU BE OUR REPORTER?

IN connection with our $12,000 prize contest announced herewith, it goes without saying that you will have to do a little work in order to win a prize. The Editors do not wish to make it hard for you, quite the contrary. We want pictures and ideas and we cannot have too many of them.

Herewith is reproduced our reporter's card. Up to now we have issued close to 11,000 of these. Note in our awards how our reporters are winning prizes right along. We shall be glad to send the reporter's card free to anyone who makes an application for it. By means of this card you will be able to secure entry into industrial plants, business houses, motion picture studios, steamships, docks, public buildings, etc. This reporter's card will prove an open sesame to you in many instances. Every card is numbered and only one is given to a correspondent. A postal card from you and a request for this reporter's card is all that is necessary to obtain one. It will be sent to you by return mail. With it we will send you a pamphlet giving rules of the contest and how to proceed in order to get photographs, to send in sketches, and other information in order to obtain a valuable prize. Not only will this card help you to obtain material for this magazine, but it will train you to become a news gatherer, and will be the means of helping you to earn a good deal of money during your spare hours.

Address Field Editor, SCIENCE AND INVENTION, 53 Park Place, New York

REPORTER

Science and Invention

CORRESPONDENT REPORTER'S IDENTIFICATION NO. 10000

THE BEARER OF THIS CARD L. K. Shackney IS AN AUTHORIZED CORRESPONDENT-REPORTER OF SCIENCE and INVENTION MAGAZINE THE PUBLISHERS OF SCIENCE AND INVENTION WILL APPRECIATE ANY COURTESY EXTENDED THEIR REPRESENTATIVE.

EXPERIMENTER PUBLISHING CO.

(over) Hugo Gernsback PRESIDENT

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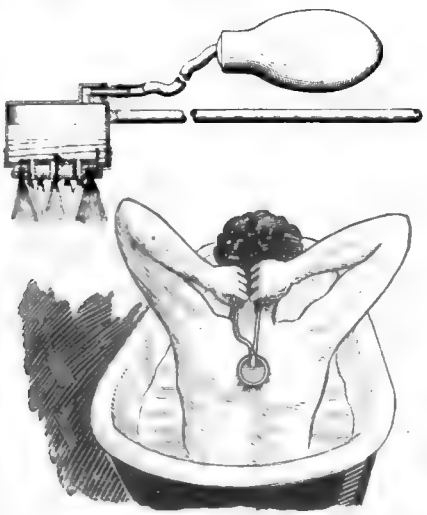
LATEST PATENTS

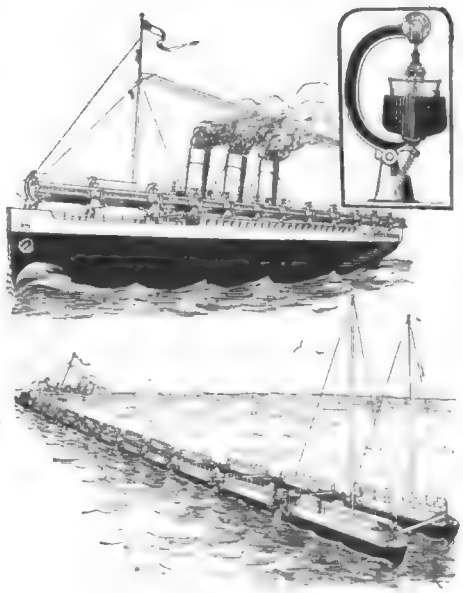
Back Brush



No. 1,485,126 issued to Henry Schumacher. Often it is desired to apply a medicated salve or powder to parts of the body which are difficult of access by the hands. Particularly is this so of the back. In this patent a receptacle containing the fluid medicament or salve is mounted on the end of a handle. It is provided on one surface with a number of brushes in bunches, which is so arranged that they will surround small openings through which the medicament may pass. A bulb forces air into the container and forces the medicament out.

Life-Saving Raft

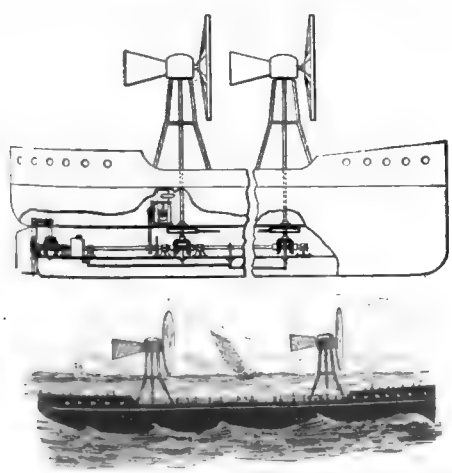
No. 1,485,280 issued to Arthur W. Lyda. In this system life rafts for a vessel are all hinged together. Each section is in the shape of a boat. The hinges permit of a vertical and a longitudinal movement of the sections. The rafts are hung on a track which is swung over the sides of the vessel by the davits. When the rail is lowered at one end the rafts slide into the water. When they strike the water they disconnect from the rail automatically.



Fly Gun

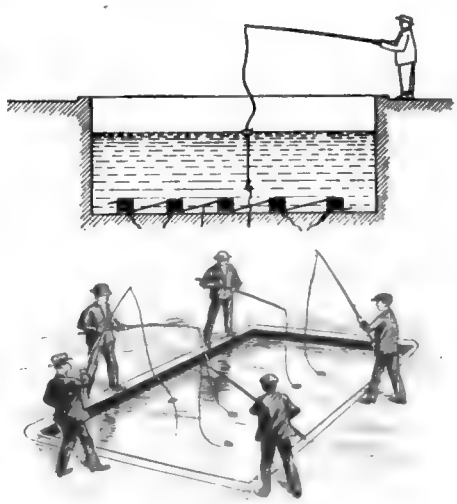
No. 1,468,373 issued to George W. Blake. Not only is this fly gun of value as an exterminator but it will also afford considerable amusement to juveniles at the same time that it contributes to the extermination of flies and other insects. The device is made in the form of a toy pistol with a spring contained in the barrel. A trigger holds the barrel in a locked position from which it may be released, causing the tubular projecting member fitted with a circle of wire screen to be discharged at the fly.

Self-Propelling Ship



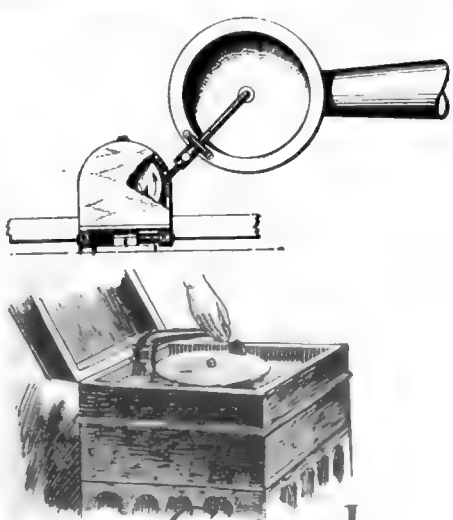
No. 1,471,870 issued to Gustav Tust. Left—the ship here illustrated is provided with two towers upon which are mounted large air turbines similar to the common farm wind-mill. This mill is connected by means of gears and shafts to the propeller, and clutches are interposed to disconnect the driving arrangement when desired. The vessel may be reversed.

Amusement Device



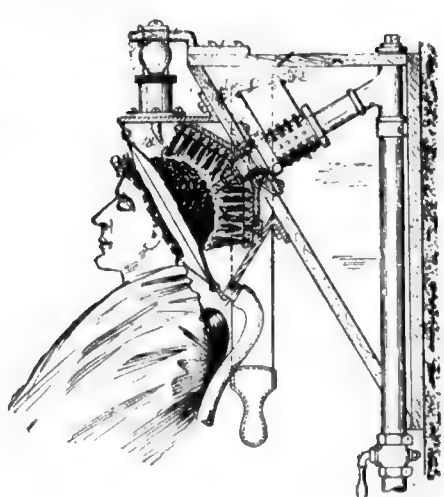
No. 1,483,579 issued to Emery M. Goodwin. Right—In a large tank one or more electro-magnetic coils are submerged and concealed from view. The contestants obtain a fishing rod which has a metallic member on the ends of the cord and a regular float. When the metallic piece is placed over one of the coils and the current turned on, the float will bob up and down. The one securing the most bites, wins.

Needle Sharpener



No. 1,482,486 issued to Walter M. Roscoe. This device is for sharpening fibre phonograph needles. It consists of a small abrasive wheel which is rotated by the action of the phonographic turn table. The fibre needle does not have to be removed from the reproducer, but is merely placed in a small hole provided for the purpose. Any dust developed by the abrasive wheel is temporarily retained in the casing. It has been found that the needle may be sharpened a great many times before it will become worthless, inasmuch as but a minute portion is ground from the needle each time.

Hair Washer



No. 1,470,311 issued to John Wirth. This apparatus serves a great many purposes in shampooing and washing the hair. To use the apparatus it is only necessary to insert the head into the rubber hood and adjust it well over the forehead, temples, ears, and nape of neck. Then turn on the water in a supply pipe and agitate the brush by moving the handles up and down. After turning off the water the chain which operates the shampooing device is pulled, and then rinses the hair. After a few more turns are given to press out surplus water from the hair, the head is withdrawn and the hair dried.

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Scientific Humor

A SONG OF SUMMER RADIO

It's easy enough to be pleasant
When your radio sings a sweet song
But the fellow worth while
Is the one who can smile
When static comes in good and strong.—
Bernardine H. Hanneman.

WONDER IF THEY PUT HIM IN A DRY CELL

GEORGE: "So they bribed the sheriff to get the charge against him?"

BEN: "Yes, it was an induced charge."—*Fritz Vanderworth.*

THEN THE CLERK BLEW UP

INDIGNANT WOMAN: "Do you guarantee your goods?"

CLERK: "Yes, lady."

INDIGNANT WOMAN: "Then give me another fuse. This one I got yesterday only worked a few minutes."—*Fritz Vanderworth.*

HIS UNDERSTANDING WAS RELATIVELY POOR

Einstein and Dr. Steinach of gland fame were giving lectures the same night in Vienna. One of the auditor's in Einstein's audience was interrogated as to the understandability of the scientist's lecture. He replied:

"Dr. Einstein has a masterly explanation of the mysterious problems of relativity but I really could not understand how it can rejuvenate people."—*Hubert Slonka, Rep. No.* 7110.

THIS IS A RINGER

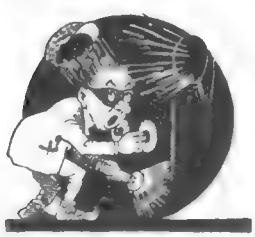
Physics instructor to class after explaining the electric bell. "What kind of a magnet is in the bell?"

BRIGHT PUPILS "A shoe-horn magnet, sir."—*Willis Dorwald.*

GREAT SNAKES

"If .— is 'A' in the Morse code, what is 'E'?"

"E-e-e is what a girl says when she sees a snake in the middle of the road."—*N. A. Welch.*



THE CRIME WAVE

It was the youthful yegg's first job. In the darkness he mistook the Neutrodyne for a safe and twirled the dials. After he had given them a couple of twists, a ministerial voice came from the loud-speaker: "Father forgive them, for they know not what they do."—*Joseph M. Straughan.*

ELECTRIFYING

Sister wears "coils."
The Cook uses "currents."
Mother wears a "transformation."
Our Milk is "condensed."
We've had our dining room "paneled."
Father has a smoking "cabinet."
All our "bulbs" are in bloom.
Brother has "wired" he's married.
We have everything "charged" at the store.
Most of our food is "storage."
We occupy the "ground" floor.
So if someone will kindly donate an "aerial" and some "switch points" to go with grandma's "switch," I am almost sure of having a "radio" outfit by next Christmas.—*E. F. Matheson.*

First Prize $3.00

A TIME FOR EVERYTHING

The most absent-minded professor was the one who, thinking he had forgotten and left his watch at home, reached into his pocket to look at it to see if he had time to go back after it.—*A. Zimmerman.*

WATT?

PROF.: "Jones, why do you want to be an electrician?"

JONES: "So that I will never be hungry. —Plenty of vi - brations."

PROF.: "Well, mind and don't volt your food."—*N. Moulton.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. No letters acknowledged unless postage is included.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to "tie" for the prize, then the sum of three dollars in cash will be paid to each one.

COLOR ON THE BRAIN

KITTIE: "That girl is a decided blond, isn't she?"

CATTY: "Yes, she decided only last week, but peroxide works fast."—*Herbert Prestwood.*

"OFT IN THE STILLY NIGHT"

Scientists calculated that we will have sunshine for at least eighty-six billion years.—Wonder how long we will have moonshine?—*Harry Cooper.*

MAYBE IT GOT INTO A JAM

Jones and Smith were discussing the strange behavior of their radio sets.

"Mine behaves just like a good little boy."

"How's that?"

"It's seen but not heard."—*Otto Law.*

THIS IS STATION E V E

SON: "Dad, what do they mean by broadcasting?"

DAD: "Telling a secret to a woman."—*Anthony Catrambone.*

RADIO GOLFERS, NOTE THIS

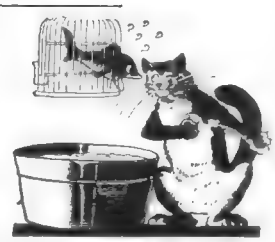
PEDAGOGUE: "What is the world's greatest plague?"

LITTLE BRIGHT EYES: "Radio, sir."

PEDAGOGUE: "Why?"

L. B. E.: "Makes liars of honest men."—*Robert Alexander.*

EVOLUTION



An experimenter was experimenting with salt water fish in a bowl and every day when he changed the water, he would put water with less salt in it into the bowl till the fish was living in fresh water.

He was so delighted with this experiment that he tried another. This time, when he changed the water, he would put less in the bowl than he did the day before till finally the fish was living without water. He then put the fish in a cage where it would hop about from perch to perch.

One day, when the cage was hanging over a tub of water the cat scared it and it fell into the water and drowned.—*Earl Hellstern.*

PHONEY

While my mother-in-law was listening to a Victrola with a radio attachment, a sermon came in. After listening for three-quarters of an hour she asked:

Doesn't it ever run down?"—*E. L. Maxwell.*

WHEN SEARCH IS RESEARCH

SOPHOMORE: "I hear Bill has completed Darwin's work."

FROSH.: "How did he find it?"

SOPH. "Oh, he just happened to look under the bed, and there it was."—*Robert Groch.*

LOUD SPEAKER

"Well, it says there that Adam made a loud speaker out of a spare part."

"Uh huh! And the loud speaker raised Cain, I suppose.—*A. Zimmerman.*

A GOOD GRAFTER

"I see by the papers that your friend Mr. Greenleaf is hailed as a second Burbank. What did he do?"

"Oh he grafted white birch with red maple and grew barber poles."—*J. Simpson.*

STOLEN

On or about November 19 to 22, a 12-guage single barrel hoke shot gun flunger has been lengthened; *also a cold storage battery from a 7 passenger Studebaker car.* Anyone knowing the whereabouts or having been offered for sale of the above described property please notify Frank Miles, R. 45.—*The De Soto Press, Mo.*

SHE FIXED HIM

Young man: "Gimme a fixed condenser."

CLERK: "I'm sorry, but we do not handle anything but new goods. It doesn't pay to fix them."—*Mrs. Oscar E. Boell.*

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THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

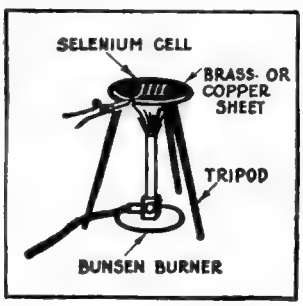
SELENIUM CELL CONSTRUCTION

(1676) Raymond F. Sachs, New Haven, Conn., asks:

Q. 1. Can you give me directions for making a simple form of selenium cell?

A. 1. This subject has been discussed time and again in this magazine but for the benefit of new readers and others who may not have seen the articles mentioned, brief instructions will be given herewith. The form of cell to be described is that known as the Bildwell type and is made by winding two bare copper wires side by side on a sheet of mica. Uusually about No. 26 wire is used, the turns being spaced $\frac{1}{32}$ of an inch apart. The ends of the wire may be fastened by passing them through holes in the mica sheet.

The application of the selenium is made as follows. The cell is laid on a copper plate, supported over a Bunsen burner as illustrated herewith and the temperature is raised to a point at which the selenium will melt when applied to the surface



At the left will be seen the method of annealing a home-made selenium cell. Very careful manipulation of the Bunsen burner is necessary and this is described thoroughly in the text.

of the cell. The entire surface is then coated with selenium, making sure that no lumps are present. The temperature throughout this part of the work must be regulated carefully for if it is too low, the selenium will turn gray, and if too high, it will collect in drops and cannot be spread. For the operation of spreading it uniformly, a sheet of mica may be used. The proper temperature for this work is approximately 220° C.

Next, lay the cell aside and adjust the burner under the copper plate so as to give a temperature of about 120° C. Place the cell on the hot copper plate and allow it to heat up again. The surface will turn gray and the temperature is to be increased until the selenium shows signs of melting. Remove the burner and allow the cell to recrystallize or again turn gray. Replace the burner, having turned it down a trifle. If no signs of melting are present, leave the cell in this condition for three or four hours, or if melting starts, lower the burner a trifle. Next, cool the cell by periodically lowering the burner a small amount, extending the process over a period of several hours.

NICKEL PLATING SOLUTION

(1677) J. R. Pierce, St. Paul, Minn., asks:

Q. 1. Can you give me the formula for a solution for nickel plating in small tank work?

A. 1. We are giving you herewith the formula:

Water, ½ gallon.
Nickel ammonium sulphate (double salt) 6 ozs.
Nickel sulphate (single salt) 1 oz.
Boric acid, 1 oz.
Ammonium chloride, ½ oz.

The double salt is dissolved in hot water. To this solution is added the single salt and the ammonium chloride. The boric acid is dissolved separately in hot water and then added to the above solution.

In all plating, the object to be plated must be kept extremely clean and free from all traces of grease and dirt, otherwise, the plating will not take very well. Before plating iron and steel parts with nickel, you should first plate them with copper using a saturated solution of copper sulphate in water.

Interesting Articles in June "Practical Electrics"

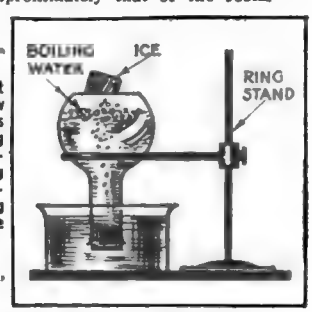
Historic Incandescent Lamps (Concluded)
By T. O'Conor Sloane, Ph.D.
Electricity Detects Counterfeit Paintings.
By M. Bayle, Director of Bureau of Identification, Paris.
Experimental Microphone.
By Frank W. Godsey, Jr.
Electric Boilers.
Utilizing Solar Heat.
Dry Cells from Wet Batteries.
By C. A. Oldroyd.
Electro-Magnetic Induction.
By Harold Jackson.
Stunts with Static.
By Harry R. Lubcke.
Sport and Science.
By Dr. Alfred Gradenwitz, Berlin Correspondent.
Talking Figures.
Flame Language.
Electric Indicator for House Owners.
By George G. McVicker.

EFFECT OF PRESSURE ON BOILING POINT

(1678) Joseph H. Koch, Kansas City, Mo., asks:

Q. 1. What effect has the atmospheric pressure upon the boiling point of a liquid.

A. 1. As the pressure decreases, the boiling point of the liquid falls. An interesting test of this can be had by nearly filling a flask with water, boiling it and then immediately corking it tight and inverting it, as shown in the illustration herewith. The boiling will cease, but can be started again by placing a piece of ice or pouring cold water on the top of the flask. This is because the cold from the ice or the water condenses the water vapor in the flask and reduces the pressure so that the latent heat of the water itself causes it to start to boil again. If at the time of the original boiling, the air has been thoroughly expelled, the water may be kept boiling by the application of cold until the temperature of the water has fallen to approximately that of the room.



The illustration at the right shows how to set up apparatus for demonstrating the effect of pressure on the boiling point. Full directions for making this experiment are given in the text.

WATER PRESSURE QUERY

(1679) William G. Green, Cleveland, Ohio, asks:

Q. 1. How can I obtain an exactly equal pressure at five openings of the same size from a pipe having a pressure at the bottom of 25 pounds per square inch?

A. 1. In order to produce the results you desire, it is only necessary to locate the five holes at equal distances from the top of the pipe. These openings could be drilled in the sides of the pipe at equal distances around the circumference with the center of each hole at exactly the same distance from the top of the pipe, presuming of course that the pipe is to be stood upright. If you desire to do this in another way, the five holes can be drilled in the base of the pipe, in this case presuming that the pipe is closed at one end. The holes need not be any particular distance apart, but they must all be of the same diameter.

OUR $12,000 PRIZE CONTEST

IT will be noted from recent issues and the present one that our prize contest has been a whale of a success. Over $1,000 has been paid out this month for worth while contributions to SCIENCE AND INVENTION, either in pictures, suggestions, ideas or articles. We now have on our staff, close to 11,000 correspondent reporters who are scouting the world for new material that can be written up for SCIENCE AND INVENTION. And the formula is simple—just keep your eyes open. Even if you were totally deaf or blind, you could still win a prize by simply using your head and sending us ideas of a scientific nature, or of a nature directly or indirectly attached to new inventions.

ARTICLES FOR JULY SCIENCE AND INVENTION

Giants in Teacups
By Ernest Brennecke.
Lightning Versus Zeppelins
By C. A. Oldroyd, Aeronautical Engineer.
Bombing New York "in the Movies"
By W. B. Arvin.
Wonders of the Human Body.
Oil Paintings Used for Movie "Sets."
Building Your Own Radio Cabinets
By William Butterfield.
Experiments with Plants
By Dr. Russell G. Harris.
Hairpin Surgical Instruments—Of Interest to Campers.
Artificial Creation of Life
By J. F. Mazur, M. B.
Scientific Bass Angling
By John E. Hogg.
The Old and New in Astronomy
By Charles T. Dahama.
Railroads of To-morrow
By George F. Murphy.
How to Build an Auto Speedster—Full Working Drawings.
Fitting an Oil Burner to Your House Furnace—Now's the Time.
How Your Lodge Button is Made.

FREE INFORMATION

IF you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Please do not fail to send stamped and self-addressed envelope. Make all questions concise and specific.

Address all inquiries of this nature to INFORMATION EDITOR c/o Science and Invention, 53 Park Place, New York City.

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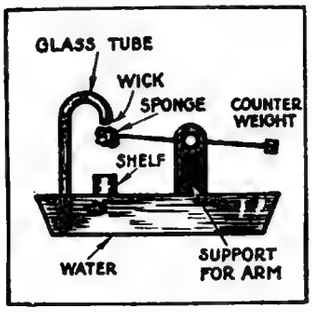
PERPETUAL MOTION

(1680) James H. Ruddy, Poughkeepsie, N. Y., submits a sketch of a device purporting to be perpetual motion and asks our opinion on the same. His sketch is reproduced herewith.

A. 1. While the device you mention will operate without any external source of power other than atmospheric conditions, still it is not perpetual motion. The rules covering the production of perpetual motion have been gone over several times in this department and the outstanding one is that the machine must operate by gravity alone. The action of the machine illustrated herewith is explained for the benefit of our readers. The sponge on the end of a rod is slightly over-balanced by a small weight. The sponge rests against the wick and absorbs water therefrom. It, therefore, becomes heavier than the weight and therefore falls. It rests on the shelf until the water has evaporated, whereupon it again is pulled up by the weight into contact with the wick. This motion will take place periodically, the speed depending upon the dryness of the atmosphere. Obviously, the action of this device is controlled by atmospheric conditions, aided by gravity and, therefore, it cannot be called true perpetual motion.



At the left will be seen an illustration of a device which approaches perpetual motion. The operation of this apparatus is explained in the text.

GASOLINE ENGINE TO DRIVE GENERATOR

(1681) F. A. Smith, New York City, asks:

Q. 1. Will a two horsepower gasoline engine be sufficiently powerful to drive a 1 K. W. D. C. generator?

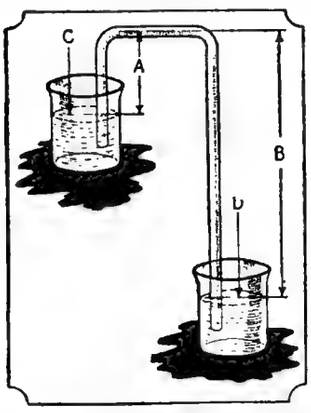
A. 1. Yes.

SIPHON QUERY

(1682) James Holgrave, Bedford, Ohio, requests:

Q. 1. Kindly state and illustrate the conditions which must be fulfilled in order to operate a siphon.

A. 1. We give herewith an illustration showing this effect. Atmospheric pressure is exerted on the surfaces of the water in the two vessels as indicated by line C and D. However, since the distance A is less than the distance B, the water in the siphon creates the greater pressure toward pipe B and the water will run in that direction after it is once started through the tube. In all cases, the delivery end of the tube must be lower than the surface of the water in the vessel from which the liquid is being drawn. The greater the distance between these points, that is, A and B in the drawing, the faster the liquid will flow.



The illustration at the left puts forth the conditions which must be met in order to cause a siphon to operate. These conditions are explained above.

GASOLINE TURBINE

(1683) W. A. Hinkle, Kansas City, Mo., wants to know:

Q. 1. Where can I obtain information on the Tesla gasoline turbine?

A. 1. Complete information on the Tesla gasoline turbine appeared in the July, 1920, and the March, 1922, issues of SCIENCE AND INVENTION.

SIPHON IN A VACUUM

(1684) J. Donovan Faust, Meadowbrook, W. Va., asks:

Q. 1. Will a siphon operate in a vacuum?

A. 1. It is quite impossible for a siphon to continue to flow when placed in a vacuum because it operates by virtue of the continuous pressure of the atmosphere. When this pressure is removed —as when the apparatus is placed in a vacuum— the siphon ceases to work.

RESONATOR TUBE DESIGN

(1685) Herbert Murphy, Charlottesville, Va., asks:

Q. 1. Is there any way except by trial to determine the volume of air giving the best resonance in a closed pipe, knowing the best length of the air column to be one-fourth of the wavelength?

A. 1. The answer which follows was kindly supplied by Prof. D. C. Miller, of the Case School of Applied Science. "The theory of such a closed pipe has been developed by both Helmholtz and Rayleigh. It is explained in some detail in Barton's 'Text Book on Sound,' page 251. Experiments have been made in connection with organ pipes and other instruments, particularly by Blaikley. These experiments are described in Barton's book on page 552.

"Theory and experiment agree in a general way. There is always an effect which is called the 'correction for the open end.' Perhaps this can be explained by saying that when the stationary wave is formed inside of the cylindrical pipe, the end of the air wave projects outward beyond the actual end of the pipe into the open air. The larger the pipe, the more this stationary wave sticks out. The amount by which the air wave projects beyond the end is the correction to the length of the pipe.

"Blaikley's experiments show that the length of the pipe closed at one end, open at the other, is equal to one-fourth of the wave-length minus 0.58 of the radius of the pipe. Thus, the larger the pipe the shorter it is for a given sound.

"However, the exact length of the pipe in practice depends somewhat upon the character of the interior surface and upon the rigidity of the walls and the nearness of other surfaces to the open end, so that actually it is much the easiest plan to determine the length by actual trial. If the pipe is of a shape different from that assumed, that is, if the cylinder is short in comparison with the diameter, the end correction will probably be different. If the resonator is of the nature of a box of any shape whatever, such as, spherical, cubical, or cylindrical, with a small opening in the side, the resonance will be very sharp and it will be very greatly influenced by the volume of air content, as well as by the exact size of the opening. While Helmholtz developed the theory of such resonators, the actual selection of a resonator suitable for a particular pitch is certainly best carried out by trial."

IMPORTANT

TO NEWSSTAND READERS

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RECLAIMING GOLD FILINGS

(1686) S. Hill, Baltimore, Md., says that he has a quantity of brass, copper and gold filings, mixed together and asks:

Q. 1. What can be applied to this mixture to destroy all the filings with the exception of the gold?

A. 1. Nitric acid will dissolve all of the filings you have with the exception of the gold. After everything is dissolved, the gold filings can be washed out.

Q. 2. Are the fumes of ammonia harmful to man?

A. 2. The fumes of ammonia are very harmful to the human lungs.

Q. 3. Can there be any harmful results from keeping an oxygen tank near a hot stove?

A. 3. The gas may increase in pressure to such an extent that it will burst the tank.

HYDROGEN ENGINE

(1687) Samuel Fuchs, Brooklyn, New York, sends us a sketch of an automobile motor designed to operate on hydrogen which is generated by the electrolysis of water. He asks:

Q. 1. Is this idea practical?

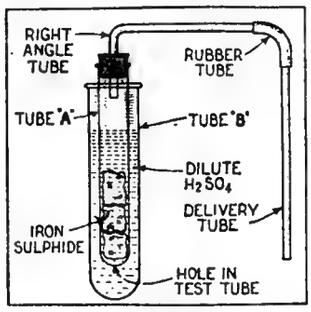
A. 1. The scheme you mention is entirely impractical as it is less efficient than the ordinary gasoline engine used on a motor car today. It has been tried several times before and proven a failure.

GAS GENERATOR

(1688) Ralph Stobel, Ithica, Mich., asks:

Q. 1. Can you give me directions for setting up a simple gas generator for making hydrogen sulphide?

A. 1. The drawing herewith illustrates such a generator. Two test tubes, A and B, are necessary, tube A fitting inside of tube B as shown. In the bottom of tube A, file a small hole with a triangular file. Fill the small tube about half full of iron sulphide. Place in the large tube a dilute solution of sulphuric acid. Place a one hole stopper in the small tube and attach a delivery tube as shown. Insert tube A in tube B and a large volume of hydrogen sulphide will be evolved.



A very simple generator for evolving hydrogen sulphide by means of acid and iron sulphide may be set up as shown at the right.

CENTRIFUGAL FORCE

(1689) Louis Koehler, Paha, Wash., requests:

Q. 1. Will you kindly give me the formula for calculating the amount of strain exerted on a cable which connects a certain body with the shaft, said shaft revolving and causing the body to fly away from the shaft by centrifugal force?

A. 1. In the formula, W = the weight of the body or car in pounds, N = the number of revolutions per minute, V = the linear velocity of the center of gravity of the body or car in feet per second, G = 32.174, a constant, R = the radius in feet of the curved path and F, the force exerted upon the cable.

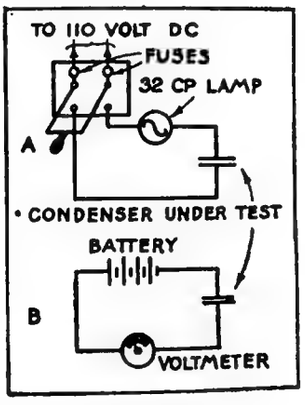
$$V = \frac{2\pi RN}{60}; \qquad F = \frac{WV^2}{GR}$$

FREEZING EXPERIMENT

(1690) H. B. Smith, Macon, Ga., asks:

Q. 1. Can you give me further information on the freezing experiment described on page 997 of the February 1924 issue of SCIENCE AND INVENTION?

A. 1. In the freezing experiment you mention a saturated solution of ammonium nitrate in water should be used. If the solution is placed in a thimble, only a small quantity of water should be placed in the plate, while if the solution is in a bowl and the plain water in the thimble, use enough solution to completely surround the thimble to within a fraction of an inch of the top. There are other freezing mixtures which will attain the same result, but the ammonium nitrate is probably one of the most efficient. The ice formed in this manner does not contain any of the chemical. The length of time for performing this experiment varies somewhat, usually being around one to five minutes.



Condensers may be tested in two different manners as shown at the right. The indications obtained for short circuit are explained below in the text.

TESTING CONDENSERS

(1691) J. R. McMahon, Rochester, New York, asks the Oracle:

Q. 1. How can condensers such as used in automobile and motorcycle electrical installations be tested for short-circuits?

A. 1. Our illustration herewith shows two methods of accomplishing this result. A shows how it can be done with 110 volts D. C. A 32 candle power lamp is connected in series with the condenser and the two placed across the line. If the lamp lights, the condenser is short-circuited. If it does not, the condenser is, in all probability, in good condition. It is, of course, taken for granted that the connections are making good contact with the tinfoil leaves.

B indicates the use of a battery for testing condensers. The battery, the condenser under test, and the voltmeter are connected as shown. If a reading is obtained on the voltmeter, the condenser is short-circuited. If not, the condenser is in good condition.

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"THE AIR IS FULL OF THINGS YOU SHOULDN'T MISS"

No. 766 "B" Battery, 22½ volts

More Power for Summer Radio

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Batteries do get used up in time. The ones you've been using, though partly exhausted, may be satisfactory for the strong winter signals, but are probably inadequate for the weaker summer signals.

For instance, use the familiar standard 22½-volt Eveready "B" Battery No. 766. It has variable taps for "soft" detector tubes. Put two, three or four in series to provide sufficient power for amplifiers.

To light the filaments of your dry cell vacuum tubes for the longest time, use Eveready Dry Cell Radio "A" Battery No. 7111. The Eveready "A" will astonish you by its long-sustained vigor. It is advisable to use two Eveready "A's" connected in multiple for each WD-11 or WD-12 tube—this gives the economical "eighth" ampere drain per cell which insures maximum economy and longer life. For sets employing one to three UV-199 tubes use three Eveready Dry Cell Radio "A" Batteries No. 7111 connected in series.

The greatest electro-chemical laboratory known created these famous dry cell batteries on which radio largely depends. The experience of thirty years in battery making stands back of them.

Eveready Radio "A" and "B" Batteries—lively, peppy, long-lived producers of power.

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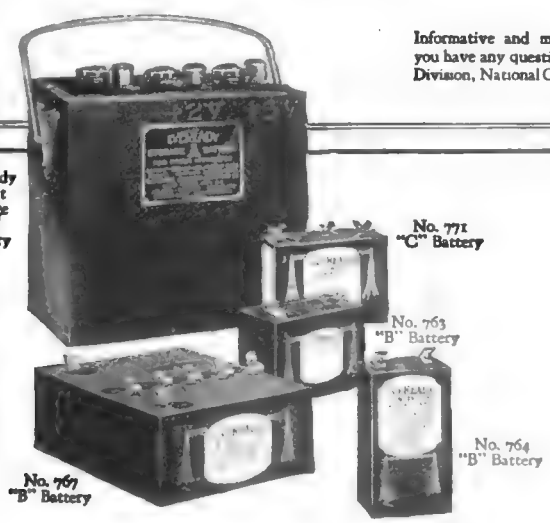

EVEREADY
Radio Batteries
—they last longer

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Radio Broadcast

Revised and corrected to date.

First group of figures indicate the power in watts in the antenna of the transmitting station. The second group gives the wave-length.

Call Letters	Name	Location	Power & Wave Length
KDKA	Westinghouse Electric & Mfg. Co.,	East Pittsburgh, Pa.	1000—326
KDPM	Westinghouse Electric & Mfg. Co.,	Cleveland, Ohio	500—270
KDPT	Southern Electrical Co.,	San Diego, Calif.	50—244
KDYL	Newhouse Hotel,	Salt Lake City, Utah	100—360
KDYM	Savoy Theatre,	San Diego, Cal.	100—280
KDYQ	Oregon Institute of Technology,	Portland, Ore.	100—360
KDYW	Smith Hughes Machinery Co.,	Phoenix, Ariz.	20—360
KDYX	Star Bulletin,	Honolulu, Hawaii	100—360
KDZB	Frank E. Siefert,	Bakersfield, Calif.	100—240
KDZE	Rhodes Co.,	Seattle, Wash.	100—270
KDZF	Automobile Club of Southern California,	Los Angeles, Calif.	500—278
KDZI	Electric Supply Co.,	Wenatchee, Wash.	50—360
KDZQ	Nichols Academy of Dancing (Hal G. Nichols),	Denver, Colo.	10—360
KDZR	Bellingham Publishing Co.,	Bellingham, Wash.	50—261
KFAD	McArthur Bros. Mercantile Co.,	Phoenix, Ariz.	100—360
KFAE	State College of Washington,	Pullman, Wash.	500—330
KFAF	Western Radio Corporation,	Denver, Colo.	50—360
KFAJ	University of Colorado,	Boulder, Colo.	100—360
KFAN	The Electric Shop,	Moscow, Idaho	50—360
KFAR	Studio Lighting Service Co. (O. K. Olsen),	Hollywood, Calif.	200—280
KFAU	Independent School District of Boise City, Boise High School,	Boise, Idaho	150—270
KFAW	The Radio Den (W. B. Ashford),	Santa Ana, Calif.	10—280
KFAY	Virgin's Radio Service (W. J. Virgin),	Medford, Ore.	50—283
KFBB	F. A. Buttrey & Co.,	Havre, Mont.	50—360
KFBC	W. K. Azbill,	San Diego, Calif.	20—278
KFBE	Reuben H. Horn,	San Luis Obispo, Calif.	10—360
KFBG	First Presbyterian Church,	Tacoma, Wash.	50—360
KFBK	Kimball-Upson Co.,	Sacramento, Calif.	100—283
KFBL	Leese Bros.,	Everett, Wash.	10—224
KFBS	Trinidad Gas & Electric Supply Co., and Chronicle News,	Trinidad, Colo.	10—360
KFBU	The Cathedral (Bishop N. S. Thomas),	Laramie, Wyo.	50—283
KFCB	Nielsen Radio Supply Co.,	Phoenix, Ariz.	10—238
KFCF	Frank A. Moore,	Walla Walla, Wash.	100—360
KFCH	Electric Service Station,	Inc., Billings, Mont.	10—360
KFCM	Richmond Radio Shop (Frank T. Doeing),	Richmond, Calif.	100—360
KFCP	Ralph W. Flygare,	Ogden, Utah	25—360
KFCV	Fred Mahaffey, Jr.,	Houston, Texas	10—360
KFCY	Western Union College,	Le Mars, Iowa	50—252
KFCZ	Omaha Central High School,	Omaha, Neb.	100—258
KFDA	Adler's Music Store,	Baker, Ore.	5—360
KFDD	St. Michaels Cathedral,	Boise, Idaho	10—252
KFDH	University of Arizona,	Tucson, Ariz.	150—360
KFDJ	Oregon Agricultural College,	Corvallis, Ore.	50—360
KFDL	Knight-Campbell Music Co.,	Denver, Colo.	5—360
KFDO	H. Everett Cutting,	Bozeman, Mont.	50—248
KFDR	Bullock's Hardware & Sporting Goods (Robert G. Bullock),	York, Neb.	10—360
KFDV	Gilbrech & Stinson,	Fayetteville, Ark.	200—360
KFDX	First Baptist Church,	Shreveport, La.	100—360
KFDY	South Dakota State College of Agriculture and Mechanic Arts,	Brookings, S. D.	100—360
KFDZ	Harry O. Iverson,	Minneapolis, Minn.	5—231
KFEC	Meier & Frank Co.,	Portland, Ore.	50—248
KFEI	Guy Greason,	Tacoma, Wash.	10—360
KFEL	Winner Radio Corp.,	Denver, Colo.	50—360
KFEQ	J. L. Scroggin,	Oak, Neb.	150—360
KFER	Auto Electric Service Co.,	Fort Dodge, Iowa	10—231
KFEV	Felix-Thompson Radio Shop,	Casper, Wyo.	250—263
KFEX	Augsburg Seminary,	Minneapolis, Minn.	100—261
KFEY	Bunker Hill & Sullivan Mining and Concentrating Co.,	Kellogg, Idaho	10—360
KFEZ	Amer. Society of Mechanical Engineers (F. H. Schubert),	St. Louis, Mo.	100—360
KFFB	Jenkins Furniture Co.,	Boise, Idaho	10—240
KFFE	Eastern Oregon Radio Co.,	Pendleton, Ore.	10—360
KFFO	Dr. E. H. Smith,	Hillsboro, Ore.	5—229
KFFQ	Marksheffel Motor Co.,	Colorado Springs, Colo.	100—360
KFFR	Nevada State Journal (Jim Kirk),	Sparks, Nev.	10—226
KFFV	Graceland College,	Lamoni, Iowa	100—360
KFFX	McGraw Co.,	Omaha, Neb.	100—278
KFFY	Pincus & Murphey,	Alexandria, La.	100—275
KFFZ	Al G. Barnes Amusement Co.,	Dallas, Texas (portable)	20—226
KFGC	Louisiana State University,	Baton Rouge, La.	100—254
KFGD	Chickasha Radio & Electric Co.,	Chickasha, Okla.	200—248
KFGH	Leland Stanford University (T. O.),	Stanford Univ., Calif.	500—360
KFGL	Arlington Garage,	Arlington, Ore.	5—234
KFGQ	Crary Hardware Co.,	Boone Iowa	10—226
KFGV	Heidbreder Radio Supply Co.,	Utica, Neb.	10—224
KFGX	First Presbyterian Church,	Orange, Texas	500—250
KFGZ	Emmanuel Missionary College,	Berrien Springs, Mich.	250—268
KFHA	Western State College of Colorado,	Gunnison, Colo.	50—252
KFHB	Rialto Theatre (P. L. Beardwell),	Hood River, Ore.	5—280
KFHD	Utz Radio and Electric Co.,	St. Joseph, Mo.	100—226
KFHF	Central Christian Church,	Shreveport, La.	150—266
KFHH	Ambrose A. McCue,	Neah Bay, Wash.	50—261
KFHJ	Fallon & Co.,	Santa Barbara, Calif.	100—360
KFHR	Star Electric & Radio Co.,	Seattle, Wash.	50—283
KFHS	Clifford J. Dow,	Lihue, Hawaii	30—275
KFHX	Robert W. Nelson,	Hutchinson, Kan.	150—229
KFI	Earle C. Anthony,	Inc., Los Angeles, Calif.	500—469
KFID	Ross Arbuckle's Garage,	Iola, Kan.	20—246
KFIF	Benson Polytechnic Institute,	Portland, Ore.	100—360
KFIL	Windisch Electric Farm Equipment Co.,	Louisburg, Kan.	30—234
KFIO	North Central High School,	Spokane, Wash.	50—252
KFIQ	Yakima Valley Radio Broadcasting Asso.,	Yakima, Wash.	50—242
KFIU	Alaska Elec. Light & Power Co.,	Juneau, Alaska	10—226
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints,	Independence, Mo.	250—240
KFIZ	Daily Commonwealth and Oscar A. Huelsman,	Fond du Lac, Wis.	100—273
KFJB	Marshall Electrical Co.,	Marshalltown, Iowa	10—248
KFJC	Seattle Post Intelligencer,	Seattle, Wash.	100—270
KFJF	National Radio Mfg. Co.,	Oklahoma City, Okla.	20—252
KFJI	Liberty Theatre (E. E. Marsh),	Astoria, Ore.	10—252
KFJK	Delano Radio & Electric Co.,	Bristow, Okla.	100—233
KFJL	Hardsacg Mfg. Co.,	Ottumwa, Iowa	10—242
KFJM	University of North Dakota,	Grand Forks, N. D.	100—280
KFJQ	Electric Construction Co., Valley Radio Division,	Grand Forks, N. D.	5—280
KFJR	Ashley C. Dixon & Son,	Stevensville, Mont. (near)	5—253
KFJV	Thomas H. Warren,	Dexter, Iowa	10—224
KFJW	Le Grand Radio Co.,	Towanda, Kan.	10—226
KFJX	Iowa State Teachers College,	Cedar Falls, Iowa	50—229
KFJY	Tunwall Radio Co.,	Fort Dodge, Iowa	50—246
KFJZ	Texas National Guard,	112th Cavalry, Fort Worth, Texas	20—254
KFKA	Colorado State Teachers College,	Greeley, Colo.	50—248

(*Continued on page* 182)

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Discovered!

The Secret of Caruso's Amazing Vocal Power

"The Songbird of the ages," Enrico Caruso. The richness, the fullness, the beauty and the astounding power of his voice was due to the exceptional development of his Hyo-Glossus muscle.

Eugene Feuchtinger, musician-scientist, who discovered the function of Hyo-Glossus in voice production, and whose famous "Perfect Voice" system has developed thousands of voices.

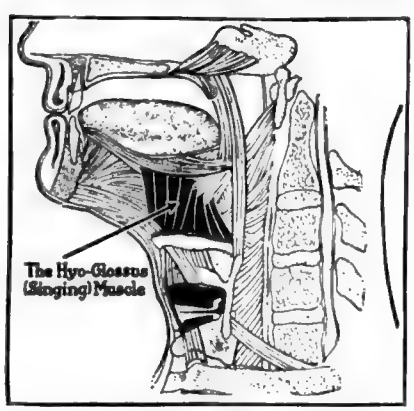

Diagram of the Normal Throat showing the Complete Vocal Mechanism. Your throat looks like this So did the throat of the great Caruso. Professor Feuchtinger's system of silent, scientific exercises will develop your vocal organ to its full strength.

THIS IS AN AGE OF MARVELS. Wonderful scientific discoveries have changed our mode of living and our mode of thinking.

One discovery of tremendous benefit to all humanity is the discovery of *the principle of voice control* by Eugene Feuchtinger, A. M.

His resulting system of voice development revolutionized old methods, and changes voice development from a little understood art to an exact science.

More than that, it brings a Perfect Voice within the reach of every man and every woman who desires a stronger, richer voice for either singing or speaking.

Prof. Feuchtinger's method is founded on the discovery that the Hyo-Glossus muscle controls the voice; that a strong, beautiful voice, with great range, is due to a well developed Hyo-Glossus—while a weak or a rasping voice is due to underdevelopment of this vital vocal muscle. A post-mortem examination of Caruso's throat showed a superb development of his Hyo-Glossi muscles. But it required years of training under the old method to produce this development.

You can develop your Hyo-Glossus in a much shorter time by Prof. Feuchtinger's wonderful scientific method. You can take this training under the direction of the Professor himself, wherever you may live. And the cost is so low that it is within the reach of every ambitious man or woman.

100% Improvement in Your Voice—*Guaranteed*

Professor Feuchtinger's method is far simpler, far more rapid, far more certain in results than the tedious, hap-hazard methods of ordinary vocal instructors. His unqualified success with thousands of pupils proves the infallibility of his method.

Under his direction, your voice will be made rich, full and vibrant. Its overtones will be greatly multiplied. You will add many notes to its range and have them clear, limpid and alluring. You will have a voice that is rolling and compelling and so strong and magnetic that it will be the marvel of your associates.

Professor Feuchtinger ABSOLUTELY GUARANTEES an improvement of 100 per cent—a REDOUBLEMENT of your voice! If you are not absolutely satisfied that your voice is doubled in volume and quality, your money will be refunded. You are the only judge.

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Send the coupon below and we will send you FREE this valuable work on voice culture. Do not hesitate to ask. Professor Feuchtinger is glad to have us give you this book, and you assume no obligation whatever by sending for it. You will do yourself a great and lasting good by studying this book. It may be the first step in your career. Do not delay. Send the coupon TODAY!

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Dear Prof. Feuchtinger: Will you please send me copy of your new free book "Enter Your World"? I understand that this free and there is no obligation on my part. I am interested in

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What I Learned About Old Age

By Byram C. Kelley, A. M., LL.D.

CERTAIN new facts about old age, recently disclosed to me, constitute the most startling information I have ever received. I am 40 years old myself. I had begun to wonder if I would soon begin to "break"—to lose my old-time pep and aggressiveness, my stamina and resistance to disease. I wondered if I would soon be subject to the class of ailments which seems so prevalent among men past 40. Then through a mutual friend, I made the acquaintance of a member of the American Association for the Advancement of Science, who has recently brought to light most interesting facts about the peculiar conditions common to men past middle age.

Why Many Men Are Old at 40

I had often wondered why so many men begin to lose their vigor and alertness when they are scarcely out of their 30's—yet others, at 60 and 70, seem to be in the prime of life. There must be some reason for this difference. And I found out exactly what this reason is.

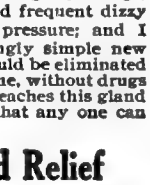
65% Have Gland Trouble

I have learned that 65% of all men past a certain middle age have a disorder of a little gland, called the prostate. And prostate disorder is not only the direct cause of much distress, often necessitating operation, but it displays itself in many parts of the body, mental as well as physical.

Common Middle Age Ailments

Here is an important cause for many ailments which heretofore have been simply taken for granted as "old age" symptoms—sciatica, aches in back, legs and feet, frequent nightly risings, nervousness and irritability and frequent dizzy spells indicating high blood pressure; and I learned how, by an astonishingly simple new method that these disorders would be eliminated in many instances in a short time, without drugs or operation—a treatment that reaches this gland directly—yet is so convenient that any one can apply it in their own home.

10,000 Men Find Relief



73 Years Young

But most surprising of all, I find that 10,000 men have already found relief. Statesmen, bankers, lawyers, doctors, in every section of the country are using and endorsing the method. I read many letters. One was from a man in Colorado, "73 years young is my age," he wrote, "yet for years I suffered with prostate trouble. Used medicine to no avail—had about given up hope when a doctor recommended your treatment." Just think of a man 73 years old being restored to the health and buoyancy of youth. And it is within the reach of every one. There are no drugs, no books, no electric rays.

All Explained in FREE Book

If you are troubled with any of the disorders mentioned, if you have chronic constipation or prostate trouble, you should send for a vitally interesting free book, written by this scientist, called "Why Many Men Are Old at 40." It describes this splendid treatment and shows how you may regain much of your youthful vigor and be free from certain disorders. No obligation. But write at once—the edition is limited. Simply mail request to **The Electro Thermal Company, 4534 Main Street, Steubenville, Ohio,** the concern that is distributing these books for the author.

RADIO BROADCAST
(Continued)

KFKB	Brinkley-Jones Hospital Association, Milford, Kan.	500—286
KFKQ	Conway Radio Laboratories (Ben H. Woodruff), Conway, Ark.	150—224
KFKV	F. F. Gray, Butte, Mont.	50—283
KFKX	Westinghouse Electric & Mfg. Co., Hastings, Neb.	1000—286
KFKZ	Nassour Bros. Radio Co., Colorado Springs, Colo.	10—234
KFLA	Abner R. Willson, Butte, Mont.	5—283
KFLB	Signal Electric Mfg. Co., Menominee, Mich.	5—248
KFLD	Paul E. Greenlaw, Franklinton, La.	20—234
KFLE	National Educational Service, Denver, Colo.	25—268
KFLH	Erickson Radio Co., Salt Lake City, Utah	50—261
KFLP	Everette M. Foster, Cedar Rapids, Iowa	20—240
KFLQ	Bizzell Radio Shop, Little Rock, Ark.	20—261
KFLR	University of New Mexico, Albuquerque, N. M.	100—254
KFLU	Rio Grande Radio Supply House, San Benito, Texas	20—236
KFLV	A. T. Frykman, Rockford, Ill.	100—229
KFLW	Missoula Electric Supply Co., Missoula, Mont.	10—234
KFLX	George R. Clough, Galveston, Texas	10—240
KFLY	Fargo Radio Supply Co., Fargo, N. D.	20—231
KFLZ	Atlantic Automobile Co., Atlantic, Iowa	100—273
KFMB	Christian Churches of Little Rock, Little Rock, Ark.	254
KFMQ	University of Arkansas, Fayetteville, Ark.	100—263
KFMR	Morningside College Sioux City, Iowa	10—261
KFMS	Freimuth Department Store, Duluth, Minn.	100—275
KFMT	George W. Young, Minneapolis, Minn.	5—231
KFMU	Stevens Bros., San Marcos, Tex.	20—240
KFMW	M. G. Sateren, Houghton, Mich.	50—266
KFMX	Carleton College, Northfield, Minn.	500—283
KFMY	Boy Scouts of America, Long Beach, Calif.	20—229
KFMZ	Roswell Broadcasting Club, Roswell, N. M.	500—250
KFNC	Monk Alonzon, Jr., First Methodist Church, Corsicana, Tex.	20—234
KFNF	Henry Field Seed Co., Shenandoah, Iowa	500—266
KFNG	Wooten's Radio Shop, Coldwater, Miss.	10—254
KFNH	State Teachers College, Springfield, Mo.	20—236
KFNJ	Warrensburg Electric Shop, Warrenburg, Mo.	50—234
KFNL	Radio Broadcast Association, Paso Robles, Calif.	10—240
KFNV	L. A. Drake, Santa Rosa, Calif.	5—234
KFNX	Peabody Radio Service, Peabody, Kan.	10—240
KFNY	Montana Phonograph Co., Helena, Mont.	5—261
KFNZ	Royal Radio Co., Burlingame, Calif.	10—231
KFOA	Rhodes Company (Dept. Store), Seattle, Wash.	500—455
KFOB	Glenwood Technical Association, Minneapolis, Minn.	5—224
KFOC	First Christian Church, Whittier, Calif.	100—236
KFOD	The Radio Shop, Wallace, Idaho	10—224
KFOF	Rohrer Electric Co., Marshfield, Ore.	10—240
KFOH	Radio Bungalow, Portland, Ore.	15—283
KFOJ	Moberly High School Radio Club, Moberly, Mo.	5—246
KFOL	Leslie M. Schafbuch, Marengo, Iowa	10—234
KFON	Echophone Radio Shop, Long Beach, Calif.	100—234
KFOP	Willson Construction Co., Dallas, Texas	100—268
KFPB	Edwin J. Brown, Seattle, Wash.	—224
KFSG	Echo Park Evangelistic Association, Los Angeles, Calif.	500—278
KGB	Tacoma Daily Ledger, Tacoma, Wash.	50—252
KGG	Hallock & Watson Radio Service, Portland, Ore.	50—360
KGN	Northwestern Radio Mfg. Co., Portland, Ore.	100—360
KGO	General Electric Co., Oakland, Calif.	1000—312
KGU	Marion A. Mulrony, Honolulu, Hawaii	500—360
KGW	Portland Morning Oregonian, Portland, Ore.	500—492
KGY	St. Martins College, Lacey, Wash.	5—258
KHJ	Times Mirror Co., Los Angeles, Calif.	500—395
KHQ	Louis Wasmer, Seattle, Wash.	100—360
KJFU	Central Power Co., Kearney, Neb.	10—234
KJQ	C. O. Gould, Stockton, Calif.	5—360

(Continued on page 184)

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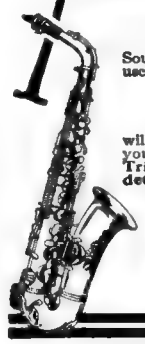

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Best type made with new improved model of best blue steel, just like you used over there. 32 Cal. just like pictured here. sacrifice price 8.45

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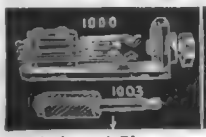
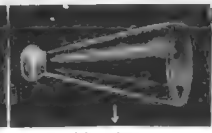


Jacks and Plugs

Best materials. Silver contacts. Factory making Postal Telegraph jacks, makes these.
V1000 Jack 4 springs $.65
V1001 Jack 3 springs .75
V1002 Jack 5 springs .80
V1003 Plug ..... .55

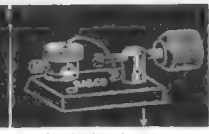
Cord Tip Jack

Takes place of binding posts. Cord tip firmly gripped by jack. Made of brass, nickel plated. Screw to attach lead wire. No soldering necessary.
V1500 Cord tip jack
Each .....$.15



Phonehorn

Base consists of Phonodapter into which fits a fine enameled fibre horn. Size of horn 12"; bell 6½". Slip Phonodapter end on a single telephone receiver.
V1321 Phonehorn, prepaid $1.45



Radiocite Detector

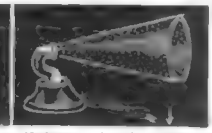
Base solid black composition. Automatic crystal holder. Triple adjustments. Smallest, neatest detector made. Radiocite crystal. 200,000 in use.
V1899 Detector ....$.60
V1898 Galena detector .....$.50

Audio Frequency Transformer

No better Transformer made. Highest class materials. Impregnated coils. Silicon steel stampings used. Save 50 per cent by assembling it yourself.
V1100 Ratio 4½-1 $2.00
V1150 Ratio 6½-1 $2.00

Duo-Cobweb Coil

For Reinartz circuit, 200-600 meters. 19 taps. Size 1¼" diam.; 1⅞" center opening. Coil is firm and will not fall apart.
V2650 Cobweb Coil $1.15
V2660 Coil for panel mounting. 225-600 met. $1.90



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Best popular loud speaker. Fibre horn, heavy metal base, five ft. cord. Nickel gooseneck. Greatest tuned (adjustable) talker. Horn length 11½"; bell 6⅝"; total height 9".
V255 Melotone Speaker $4.85

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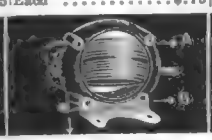
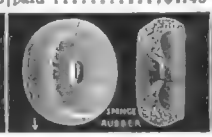
The big "Rasco" catalogue. Contains all Armstrong circuits. Every up-to-date vacuum tube hookup. Greatest little book printed. **Free upon receipt of postal.**



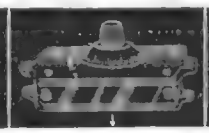
Molded Variometer

Highly substantial instrument. Silk windings. ¼" shaft. Flange B when placed into AB direction makes instrument panel mounting. 180 to 650 meters. Money back if this instrument is not all that we claim for it.
V5350 Variometer $3.00



FONEKUSHIONS

Made of sponge rubber. Make wearing your receivers a pleasure. Positively exclude all noises and make reception a pleasure. Sponge rubber will last for years. Light as a feather.
V3550 Fonekushions, set of two .....$.50

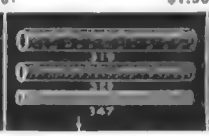


Straight Line Condenser

Simplest and most practical type of condenser.
V4430 "Rico" Condenser .001 mfd. 43 plate capacity $1.75
V4230 .0005 mfd. 23 plate capacity $1.75
V4110 .00025 mfd. 11 plate capacity $1.75
All types no dials $1.50

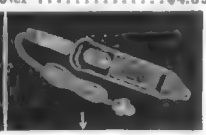
Radio Frequency Transformers

Best Radio Frequency Transformer developed so far. Designed by R. E. Lacault, Associate Editor RADIO NEWS. Air core type.
V2800 Transformer, size 1⅞"x2½" $1.50



Spaghetti

Varnished flexible cambric tubing, 319 takes No. 22 wire; 320 takes 18 to 20 wire; 21 takes 16 to 18 wire; 344 takes 22 to 28 wire.
V319-320-321 Per ft. $.06
V344 Flexible soft rubber tubing; 10 feet for..$.20



Soldering Iron

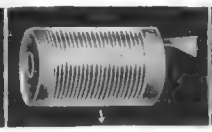
Smallest and handiest made. Fits any flat iron or percolator plug. Plug then becomes handle. 5" long. Complete but without plug or wire.
V2200 Soldering iron $1.45

Formica Panels
Clearance Sale

As we are discontinuing these particular sizes, this material is now offered at cost. All 3-16" thick.
V352 9x12" each $1.75
V354 6½x19½" ea. 1.90
V356 6x14" each.. 1.60
V357 6x 4" each.. .65

Brass Rods

Sold in 6" lengths only.
V8032 Rod, 8-32" thread length .....$.08
V6032 Rod, 6-32" thread length .....$.06
V1425 Rod, plain ¼" round, length .....$.10
V3616 Rod, plain 3-16" round, length .....$.06



Litz Wire

Prices are per foot. E— equals.
V823 E No. 25 B&S $.02
V890 E No. 28 B&S .01
V891 E No. 21 B&S .03
V892 E No. 20 B&S .04
10 per cent discount in 100 foot lots.

Copper Ribbon

.005" thick.
V700 ⅜" wide; V701 ¼" wide; V702 3-16" wide. All sizes per foot...$.01

Copper Foil

.001" thick. 4" wide.
V5025 Copper Foil per foot .....$.10
10-foot length ..... .80

Tin Foil

All our tin foils come 4" wide. Uniform product throughout.
Best grade only V850 has 1500 sq. inches per lb.
V851 700 sq. inches to lb.
V850 Tin foil...lb. $.48
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Switch Knob

V199 Knob, 1⅛" dia. height ⅝"; 8-32" screw.
V4451 has 8-32" or 10-32" bushing, no screw
V199 Knob .....$.10
V4451 Knob ..... .06

Marconi Knob

Has central hole of 5-32" and seat to hold screw. dia. 1¼", height ⅝".
V838 Knob, each..$.12

Fluted Knob

With 8-32" bushing. Black composition.
V2055 Knob 1" high 1¼" diam. each ..... $.15

Mounted Crystal-Cup

Cup has screw and adjustment nut. Fits all standard mounted crystals. Nickel plated, polished.
V318 Nickel Cup ..$.20

Radiocite

Best most sensitive mounted crystal. U. S. Navy using it. Each tested.
V317 Radiocite Crystal .....$.25

Rasco Vernier

Why use a vernier condenser when a vernier attachment will do anything and everything a vernier condenser accomplishes? Cleverest vernier made. Can be used with any dial. Soft rubber ring engages dial. Nothing to come apart.
V1450 Vernier ....$.30

Angle Bushing

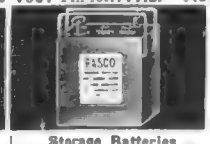
Angle piece used to mount panels on board, tubes on panels, etc., 1,000 uses 5-16" wide, height 7-16".
V1475 Angle piece.
Each .....$.03

Adapter Bushing

Makes 3-16" dial fit ¼" shaft. ⅛" long.
V8866 Bushing ....$.04

Silver Dials

Silver surface black enamel lettering. For ¼" shaft. No set screw required. All 2½" dia.
V800 Plate variometer; V801 Prim. Con.; V802 Sec. Cond.; V803 Coupler; V804 Fil. Rheo.; V805 Grid Variometer.
Each style .....$.20 each
Set of six.....$1.15



Storage Batteries

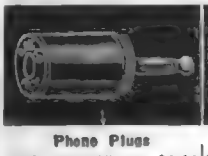
Guaranteed for two years. Only NEW material used. Acid proof terminals. Patent vents.
V2400 Two volt, 40 amp. hours $3.90
V640 Six volt, 40 amp. hours 7.25
V666 Six volt, 60 amp. hours 9.50
Shipped express collect.

Vario-Rotor

Made of hard wood, accurately turned. Takes any finish. Large hole 2" diameter. Width 2", diameter 3⅝". 2 shaft holes
V343 Rotor .....$.30
"Rasco" Universal Bearing. Especially made to take above rotor for panel mounting.
V1375 Uni. Bearing $.25

Rheostats and Potentiometers

High heat dielectric base. Come with tapered, knurled knob, 2½" dia. Complete with pointer.
V4310 6 ohm.....$.45
V4311 30 ohm..... .65
V4312 Potentiometer, 200 ohms ..... .85



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Sold from 75c to $1.00 everywhere. Hard rubber composition shell and patented cord tip holder. Finest workmanship throughout.
V1030 Rasco Telephone Plug, each .....$.35

Bakelite Socket

Octagon shape. Four nickel binding posts, phosphor bronze contact springs. Best brown bakelite.
V6510 Bakelite socket $.40
V6500 Tube Socket. Made entirely of composition. Best made. Each...$.35

Condensers

Best make, paper-impregnated condensers. Capacity guaranteed.
V5050 Phone Condenser, .001 .....$.20
V5056 Grid Condenser, .00025 .....$.20
V5059 Grid Leak Condenser, .00025 ....$.30

Name Plates

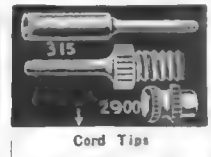
All name plates brass with silver letters.
V839 (Right or left) $.10
V809 Comes in 35 styles Any denomination, each style .....$.04
Panel Scale, 2½", 90° metal, silver background, black lettering.
V715 Scale. Each...$.15

Binding Post Name Plates

Dia. ¾". These styles. Phones, Ground, —. Output, "A" Bat. —, "B" Bat. —, Loud Speaker, "C" Bat. —, Aerial, +. Input, "A" Bat. +, "B" Bat. +, Loop "C" Bat. +.
V6000 Name Plates, all styles, each .....$.03

"Rasco" Posts

Made of black composition.
V650-51 Each.....$.08
V202 Has nickel-plated bottom, each .....$.08
Dozen, each style...$.90
V122 Initialed Binding Posts. Six popular styles Each .....$.10



Cord Tips

Standard phone cord tips, pinched.
V315 Each .....$.03

Separable Cord Tips

No solder required. Wire goes in ferrule. Shank holds it tight. Nickel plated.
V2900 Each .....$.06

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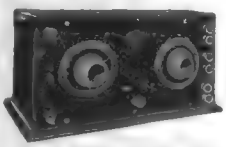

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The famous Autoplex circuit described in RADIO NEWS has taken the country by storm. The only single tube outfit that works a loud-talker. Results guaranteed.

1—V714 Mahogany Cabinet, 7x14" $3.35
1—V7140 Dilectrite Panel, 7x14" ... 1.20
2—V5350 Moulded Variometers 6.00
2—V3076 4" Dials... .80
1—V5014 1250 turn Honeycomb coil.. 1.95
1—V6500 Vacuum Tube Socket ..... .35
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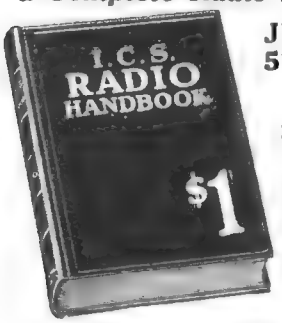

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KJS	Bible Institute of Los Angeles, Los Angeles, Calif.	750—360
KLS	Warner Bros. Radio Supplies Co., Oakland, Calif.	250—360
KLX	Tribune Publishing Co., Oakland, Calif.	250—509
KLZ	Reynolds Radio Co., Denver, Colo.	500—360
KMJ	San Joaquin Lt. & Power Corp., Fresno, Calif.	50—273
KMO	Love Electric Co., Tacoma, Wash.	10—360
KNT	Grays Harbor Radio Co. (Walter Hemrich), Aberdeen, Wash.	250—263
KNV	Radio Supply Co., Los Angeles, Calif.	100—256
KNX	Electric Lighting Supply Co., Los Angeles, Calif.	100—360
KOB	New Mexcio College of Agriculture and Mechanic Arts, State College, N. M.	500—360
KOP	Detroit Police Dept., Detroit, Mich.	500—286
KPO	Hale Bros., San Francisco, Cal.	500—423
KQP	Apple City Radio Club, Hood River, Ore.	10—360
KQV	Doubleday Hill Electric Co., Pittsburgh, Pa.	250—360
KQW	Chas. D. Herrold, San Jose, Calif.	50—360
KRE	Berkeley Daily Gazette, Berkeley, Calif.	50—275
KSD	Post Dispatch (Pulitzer Pub. Co.), St. Louis, Mo.	500—546
KSS	Prest & Dean Radio Co. & Radio Research Society of Long Beach, Calif.	20—360
KTW	First Presbyterian Church, Seattle, Wash.	750—360
KUO	Examiner Printing Co., San Francisco, Calif.	150—360
KUS	City Dye Works & Laundry Co., Los Angeles, Calif.	100—360
KUY	Coast Radio Co., El Monte, Calif.	50—256
KWG	Portable Wireless Telephone Co., Stockton, Calif.	100—360
KWH	Los Angeles Examiner, Los Angeles, Calif.	500—360
KXD	Modesto Herald Publishing Co., Modesto, Calif.	5—252
KYQ	Electric Shop, Honolulu, Hawaii	100—270
KYW	Westinghouse Electric & Mfg. Co., Chicago, Ill.	1000—536
KZM	Preston D. Allen, Oakland, Calif.	50—360
KZN	The Desert News, Salt Lake City, Utah	500—360
KZV	Wenatchee Battery & Motor Co., Wenatchee, Wash.	50—360
WAAB	Valdemar Jensen, New Orleans, La.	100—268
WAAC	Tulane University, New Orleans, La.	400—360
WAAD	Ohio Mechanics Institute, Cincinnati, Ohio	25—360
WAAF	Chicago Daily Drover's Journal, Chicago, Ill.	200—286
WAAM	I. R. Nelson Co., Newark, N. J.	250—263
WAAN	University of Missouri, Columbia, Mo.	50—254
WAAW	Omaha Grain Exchange, Omaha, Neb.	200—360
WABA	Lake Forest College, Lake Forest, Ill.	100—266
WABB	Dr. John B. Lawrence, Harrisburg, Pa.	10—266
WABD	Parker High School, Dayton, Ohio	10—283
WABE	Young Men's Christian Association, Washington, D. C.	100—283
WABG	Arnold Edwards Piano Co., Jacksonville, Fla.	10—275
WABH	Lake Shore Tire Co., Sandusky, Ohio	10—240
WABI	Bangor Railway & Electric Co., Bangor, Maine	100—240
WABK	First Baptist Church, Worcester, Mass.	10—252
WABL	Connecticut Agricultural College, Storrs, Conn.	100—283
WABM	F. E. Doherty Automotive & Radio Equipment Co., Saginaw, Mich.	100—254
WABN	Ott Radio, Inc., LaCrosse, Wis.	250—244
WABO	Lake Ave. Baptist Church, Rochester, N. Y.	10—252
WABP	Robert F. Weinig, Dover, Ohio	100—266
WABQ	Haverford College Radio Club, Haverford, Pa.	50—261
WABR	Scott High School, Toledo, Ohio	50—270
WABS	Essex Manufacturing Co., Newark, N. J.	50—244
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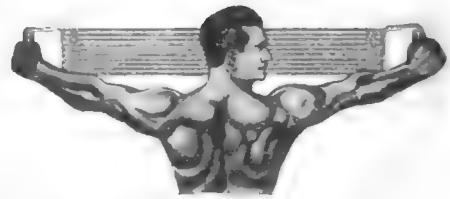

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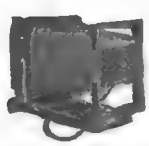

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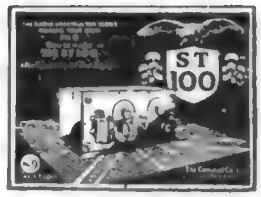

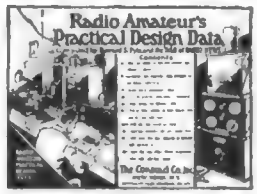

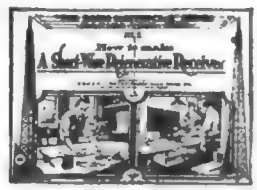

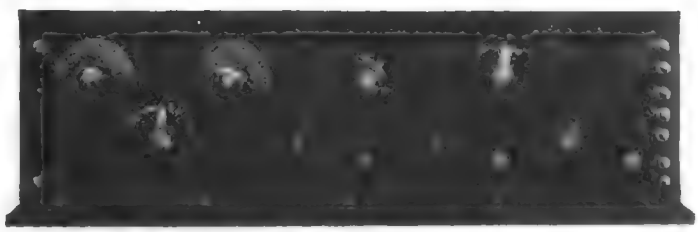

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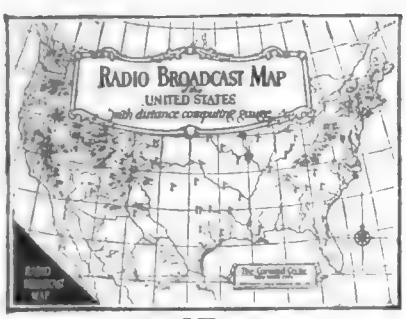

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WABY	John Magaldi, Jr., Philadelphia, Pa.	50—242
WABZ	Coliseum Place Bapitst Church, New Orleans, La.	50—263
WBAA	Purdue University, West Lafayette, Ind.	250—360
WBAD	Sterling Electric Co., Minneapolis, Minn.	100—360
WBAH	The Dayton Co., Minneapolis, Minn.	500—417
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WBAX	John H. Stenger, Jr., Wilkes-Barre, Pa.	20—360
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WBBA	Newark Radio Laboratories, Newark, Ohio	10—240
WBBD	Barbey Battery Service, Reading, Pa.	50—234
WBBE	Alfred R. Marcy, Syracuse, N. Y.	10—246
WBBF	George School of Technology, Atlanta, Ga.	500—270
WBBG	Irving Vermilya, Mattapoisett, Mass.	100—240
WBBH	J. Irving Bell, Port Huron, Mich.	50—246
WBBI	Indianapolis Radio Club, Indianapolis, Ind.	20—234
WBBJ	Neel Electric Co., West Palm Beach, Fla.	50—258
WBBL	Grace Covenant Church, Richmond, Va.	50—283
WBBM	Frank Atlass Produce Co., Lincoln, Ill.	200—226
WBBN	A. B. Blake, Wilmington, N. C.	10—275
WBBO	Michigan Limestone & Chemical Co., Rogers, Mich.	500—250
WBBP	Petoskey High School, Petoskey, Mich.	10—246
WBBQ	Frank Crook, Pawtucket, R. I..	50—252
WBBR	Peoples Pulpit Association, Rossville, N. Y.	500—244
WBBS	First Baptist Church, New Orleans, La.	100—250
WBBT	Lloyd Brothers, Philadelphia, Pa.	5—234
WBBU	Jenks Motor Sales Co., Monmouth, Ill.	10—224
WBBV	Johnstown Radio Co., Johnstown, Pa.	5—248
WBBW	Ruffner Junior High School, Norfolk, Va.	50—222
WBBY	Washington Light Infantry, Charleston, S. C.	20—268
WBBZ	Noble B. Watson, Indianapolis, Ind.	50—227
WBL	T & H Radio Company, Anthony, Kan.	100—261
WBS	D. W. May (Inc.), Newark, N. J.	10—360
WBT	Southern Radio Corp., Charlotte, N. C.	500—360
WBZ	Westinghouse Electric & Mfg. Co., Springfield, Mass.	1000—337
WCAD	St. Lawrence University, Canton, N. Y.	250—280
WCAE	Kaufman & Baer Co., Pittsburgh, Pa.	500—462
WCAG	Clyde R. Randall, New Orleans, La.	50—268
WCAH	Entrekin Electric Co., Columbus, Ohio	100—286
WCAJ	Nebraska Wesleyan University, University Place, Neb.	500—360
WCAK	Alfred P. Daniel, Asst. Division Mgr., A. R. R. L., Houston, Texas	50—263
WCAL	St. Olaf College, Northfield, Minn.	500—360
WCAM	Villanova College, Villanova, Pa.	150—360
WCAO	The Sanders and Stayman Co., Baltimore, Md.	50—360
WCAP	Chesapeake & Potomac Telephone Co., Washington, D. C.	500—469
WCAR	Southern Radio Corp. of Texas, San Antonio, Texas	100—360
WCAS	Wm. Hood Dunwoody Industrial Institute, Minneapolis, Minn.	100—280
WCAT	South Dakota State School of Mines, Rapid City, S. D.	100—240
WCAU	Durham & Co., Philadelphia, Pa.	100—286
WCAV	J. C. Dice Electric Co., Little Rock, Ark.	20—360

(Continued on page 188)

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You can rule your health just as surely as you can rule your actions. If you are not enjoying perfect health today it is because you haven't employed the method provided by Nature to keep you well. If you don't know what her requirements are, you are sure to blunder into some kind of sickness—perhaps fatal disease.

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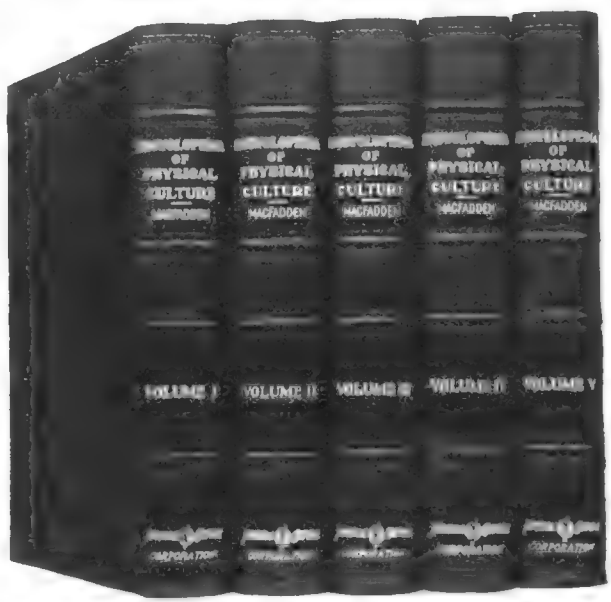

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eat for health
diet for the cure of disease
know the art of food preparation
build a powerful physique
correct physical imperfections
become a physical director
avoid unhappy marriages
avoid disease
fast as a curative measure
cure by hydropathy (heal by the use of water)
apply all methods of drugless healing
give first aid in emergencies
apply home treatment for disease
recognize diseases by manifestations
build nervous energy
treat the common forms of disease
understand the process of reproduction
benefit by laws of sex and marriage
treat diseases of women
diagnose diseases
have healthy and vigorous children
treat female disorders
treat male disorders
obtain virility and manhood
care for the complexion
manicure; care for the hair and feet
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RADIO BROADCAST

(Continued)

Call Letters	Name	Location	Power & Wave Length
WCAX	University of Vermont,	Burlington, Vt.	50—360
WCAY	Kesselman O'Driscoll Co.,	Milwaukee, Wis.	250—261
WCAZ	Carthage College,	Carthage, Ill.	50—246
WCBA	Charles W. Humbach,	Allentown, Pa.	10—280
WCBC	University of Michigan,	Ann Arbor, Mich.	200—280
WCBD	Wilbur G. Voliva,	Zion, Ill.	500—345
WCBE	Uhalt Radio Co.,	New Orleans, La.	5—263
WCBG	Howard S. Williams,	Pascagoula, Miss. (portable)	10—254
WCBH	University of Mississippi,	Oxford, Miss. (near)	20—242
WCK	Stix Baer & Fuller Dry Goods Co.,	St. Louis, Mo.	100—360
WCM	University of Texas,	Austin, Texas	500—360
WCX	The Detroit Free Press,	Detroit, Mich.	500—517
WDAE	Tampa Daily Times,	Tampa, Fla.	250—360
WDAF	Kansas City Star,	Kansas City, Mo.	500—411
WDAG	J. Laurance Martin,	Amarillo, Texas	100—263
WDAH	Trinity Methodist Church (South),	El Paso, Texas	50—268
WDAK	The Courant,	Hartford, Conn.	100—261
WDAO	Automotive Electric Co.,	Dallas, Texas	50—360
WDAP	Board of Trade,	Chicago, Ill.	1000—360
WDAR	Lit Bros.,	Philadelphia, Pa.	500—395
WDAS	Samuel A. Waite,	Worcester, Mass.	5—360
WDAU	Slocum & Kilburn,	New Bedford, Mass.	100—360
WDAY	Radio Equipment Corp.,	Fargo, N. D.	50—244
WDBC	Kirk Johnson & Co.,	Lancaster, Pa.	50—258
WDM	The Church of the Covenant,	Washington, D. C.	50—234
WDZ	J. L. Bush,	Tuscola, Ill.	10—278
WEAA	Frank D. Fallain, Police Building,	Flint, Mich.	10—280
WEAF	American Telephone & Telegraph Co.,	New York, N. Y.	500—492
WEAH	Wichita Board of Trade,	Wichita, Kan.	50—280
WEAI	Cornell University,	Ithaca, N.Y.	500—286
WEAJ	University of South Dakota,	Vermillion, S. D.	100—283
WEAM	Borough of North Plainfield (W. Gibson Buttfield),	North Plainfield, N. J.	100—252
WEAN	Shepard Co.,	Providence, R. I.	100—273
WEAO	The Ohio State University,	Columbus, Ohio	500—360
WEAP	Mobile Radio Co.,	Mobile, Ala.	100—360
WEAR	Baltimore American News Publishing Co.,	Baltimore Md.	50—360
WEAS	Hecht Co.,	Washington, D. C.	100—360
WEAU	Davidson Bros. Company,	Sioux City, Iowa	100—360
WEAY	Will Horwitz, Jr.,	Houston, Texas	500—360
WEB	Benwood Co.,	St. Louis, Mo.	500—273
WEV	Hurlburt-Still Electrical Co.,	Houston, Texas	50—360
WEW	St. Louis University,	St. Louis, Mo.	100—261
WFAA	The Dallas News, The Dallas Journal,	Dallas, Texas	500—476
WFAB	Carl F. Woese,	Syracuse, N. Y.	100—234
WFAF	H. C. Spratley Radio Co.,	Poughkeepsie, N. Y.	20—360
WFAH	Electric Supply Co.,	Port Arthur, Texas	150—236
WFAJ	Hi-Grade Wireless Instrument Co.,	Asheville, N. C.	50—360
WFAM	Times Publishing Co.,	St. Cloud, Minn.	20—360
WFAN	Hutchinson Electric Service Co.,	Hutchinson, Minn.	100—360
WFAQ	Missouri Wesleyan College,	Cameron, Mo.	10—360
WFAV	University of Nebraska, Dept. E. E.,	Lincoln, Neb.	500—275
WFI	Strawbridge & Clothier,	Philadelphai, Pa.	500—395
WGAL	Lancaster Elec. Supply & Const. Co.,	Lancaster, Pa.	10—248
WGAN	Cecil E. Lloyd,	Pensacola, Fla.	50—360
WGAQ	Glenwood Radio Corp. (W. G. Patterson),	Shreveport, La.	150—252
WGAW	Ernest C. Albright,	Altoona, Pa.	100—261
WGAZ	The South Bend Tribune,	South Bend, Ind.	250—360
WGI	American Radio & Research Corp.,	Medford Hillside, Mass.	500—360
WGL	Thomas F. J. Howlette,	Philadelphia, Pa.	500—360
WGR	Federal Telephone and Telegraph Co.,	Buffalo, N. Y.	500—319
WGV	Interstate Electric Co.,	New Orleans, La.	100—242
WGY	General Electric Co.,	Schenectady, N. Y.	1000—380

(Continued on page 190)

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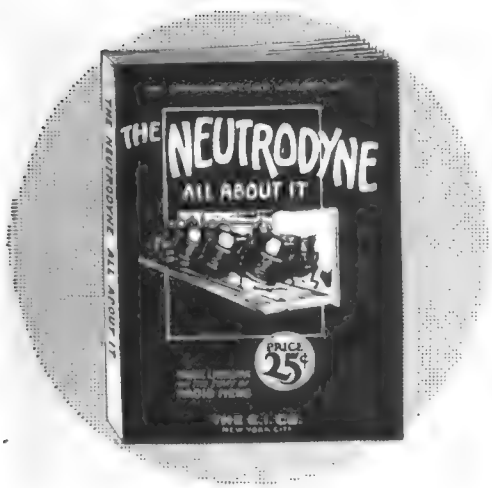

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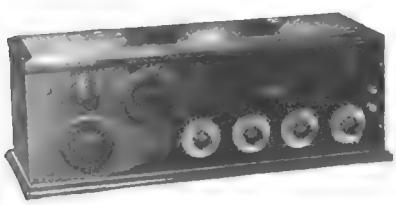

MIDWEST RADIO CO.
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RADIO BROADCAST (Continued)

Call Letters	Name	Location	Power & Wave Length
WHA	University of Wisconsin,	Madison, Wis.	500—360
WHAA	State University of Iowa,	Iowa City, Iowa	100—484
WHAB	Clark W. Thompson,	Galveston, Texas	200—360
WHAD	Marquette University,	Milwaukee, Wis.	100—280
WHAG	University of Cincinnati,	Cincinnati, Ohio	100—222
WHAH	Hafer Supply Co.,	Joplin, Mo.	250—283
WHAK	Roberts Hdwe. Co.,	Clarksburg, W. Va.	15—258
WHAM	University of Rochester (Eastman School of Music),	Rochester, N. Y.	100—283
WHAP	Otta & Kuhns,	Decatur, Ill.	50—360
WHAR	Paramount Radio & Electric Co. (W. H. A. Paulus),	Atlantic City, N. J.	10—231
WHAS	Courier-Journal and Louisville Times,	Louisville, Ky.	500—400
WHAV	Wilmingotn Electrical Specialty Co., Inc.,	Wilmington, Del.	50—360
WHAZ	Rensselaer Polytechnic Institute,	Troy, N. Y.	500—380
WHB	Sweeney School Co.,	Kansas City, Mo.	500—411
WHK	Radiovox Co. (Warren R. Cox),	Cleveland, Ohio	100—360
WHN	George Schubel, Loew's State Theatre Bldg.,	New York, N. Y.	500—360
WIAB	Joslyn Automobile Co.,	Rockford, Ill.	50—252
WIAC	Galveston Tribune,	Galveston, Texas	100—360
WIAD	Howard R. Miller,	Philadelphia, Pa.	100—254
WIAF	Gustav A. DeCortin,	New Orleans, La.	10—234
WIAI	Heer Stores Co.,	Springfield, Mo.	20—252
WIAJ	Fox River Valley Radio Co.,	Neenah, Wis.	20—224
WIAK	Journal-Stockman Co.,	Omaha, Neb.	200—278
WIAO	School of Engineering of Milwaukee,	Milwaukee, Wis.	100—360
WIAQ	Chronicle Publishing Co.,	Marion, Ind.	10—226
WIAR	Paducah Evening Sun,	Paducah, Ky.	100—360
WIAS	Home Electric Co.,	Burlington, Iowa	100—360
WIAU	American Trust & Savings Bank,	Le Mars, Iowa	20—360
WIK	K & L Electric Co.,	McKeesport, Pa.	100—234
WIL	Continental Electrical Supply Co.,	Washington, D. C.	10—360
WIP	Gimbel Bros.,	Philadelphia, Pa.	500—509
WJAD	Jackson's Radio Engineering Laboratories,	Waco, Texas	150—360
WJAF	Muncie Press & Smith Electric Co.,	Muncie, Ind.	10—360
WJAG	The Norfolk Daily News,	Norfolk, Neb.	250—283
WJAK	Clifford L. White,	Greentown, Ind.	30—254
WJAM	D. M. Perham,	Cedar Rapids, Iowa	20—268
WJAN	Peoria Star,	Peoria, Ill.	100—280
WJAQ	Capper Publications,	Topeka, Kan.	100—360
WJAR	The Outlet Co. (J. Samuels & Bro.),	Providence, R. I.	500—360
WJAS	Pittsburgh Radio Supply Co.,	Pittsburgh, Pa.	250—250
WJAT	Kelley-Vawter Jewelry Co.,	Marshall, Mo.	10—360
WJAX	Union Trust Co.,	Cleveland, Ohio	500—390
WJAZ	Chicago Radio Laboratory,	Chicago, Ill.	1000—448
WJD	Denison University,	Granville, Ohio	50—229
WJH	Wm. P. Boyer Co.,	Washington, D. C.	50—273
WJX	De Forest Radio Telephone & Telegraph Co.,	New York, N. Y.	500—360
WIY	R. C. A.,	New York, N. Y.	500—405
WIZ	R. C. A.,	New York, N. Y.	500—455
WKAA	H. F. Paar,	Cedar Rapids, Iowa	100—268
WKAD	Charles Looff (Crescent Park),	East Providence, R. I.	10—240
WKAF	W. S. Radio Supply Co.,	Wichita Falls, Texas	100—360
WKAN	United Battery Service Co.,	Montgomery, Ala.	15—226
WKAP	Dutee W. Flint,	Cranston, R. I.	200—360
WKAQ	Radio Corp. of Porto Rico,	San Juan, Porto Rico	100—360
WKAR	Michigan Agriculture College,	East Lansing, Mich.	500—280
WKAV	Laconia Radio Club,	Laconia, N. H.	50—254
WKAY	Brenau College,	Gainesville, Ga.	10—280
WKY	W. K. Y. Radio Shop,	Oklahoma City, Okla.	500—360

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Call Letters	Name	Location	Power & Wave Length
WLAG	Cutting & Washington Radio Corp.,	Minneapolis, Minn.	500—417
WLAH	Samuel Woodworth,	Syracuse, N. Y.	100—234
WLAJ	Waco Electrical Supply Co.,	Waco Texas	150—360
WLAK	Vermont Farm Machine Corp.,	Bellows Falls, Vt.	100—360
WLAL	Naylor Electrical Co. (Sim Naylor),	Tulsa, Okla.	100—360
WLAP	W. V. Jordon,	Louisville, Ky.	15—360
WLAQ	Arthur E. Schilling,	Kalamazoo, Mich.	20—283
WLAV	Electric Shop,	Pensacola, Fla.	15—254
WLAW	Police Dept.,	New York, N. Y.	500—360
WLAX	Putnam Electric Co.,	Greencastle, Ind.	10—231
WLB	University of Minnesota,	Minneapolis, Minn.	25—360
WLW	Crosley Manufacturing Co.,	Cincinnati, Ohio	500—309
WMAB	Radio Supply Co.,	Oklahoma City, Okla.	100—360
WMAC	Clive B. Meredith,	Cazenovia, N. Y.	200—261
WMAF	Round Hills Radio Corp.,	Dartmouth, Mass.	100—500—360
WMAH	General Supply Co.,	Lincoln, Neb.	50—254
WMAJ	Drovers Telegram Co.,	Kansas City, Mo.	250—275
WMAK	Norton Laboratories,	Lockport, N. Y.	500—360
WMAL	Trenton Hardware Co.,	Trenton, N. J.	50—256
WMAN	First Baptist Church,	Columbus, Ohio	10—286
WMAP	Utility Battery Service,	Easton, Pa.	150—246
WMAQ	Chicago Daily News,	Chicago, Ill.	500—448
WMAV	Alabama Polytechnic Inst.,	Auburn, Ala.	250—250
WMAW	Wahpeton Elec. Co.,	Wahpeton, N. D.	50—254
WMAY	Kingshighway Presbyterian Church,	St. Louis, Mo.	100—280
WMAZ	Mercer University,	Macon, Ga.	50—268
WMC	Commercial,	Memphis, Tenn.	500—500
WMU	Doubleday - Hill Electric Co.,	Washington, D. C.	50—261
WNAC	Shepard Stores,	Boston, Mass.	100—278
WNAD	University of Oklahoma,	Norman, Okla.	50—360
WNAL	R. J. Rockwell,	Omaha, Neb.	20—266
WNAN	Syracuse Radio Telephone Co.,	Syracuse, N. Y.	100—286
WNAP	Wittenberg College,	Springfield, Ohio	100—275
WNAQ	Charleston Radio Electric Co.,	Charleston, S. C.	10—360
WNAR	C. C. Rhodes,	Butler, Mo.	20—231
WNAS	Texas Radio Corp. & Austin Statesman,	Austin, Texas	100—360
WNAT	Lennig Bros. Co. (Fred'k Lennig),	Philadelphia, Pa.	250—360
WNAV	People's Telephone & Telegraph Co.,	Knoxville, Tenn.	500—236
WNAW	Henry Kunzman,	Fort Monroe, Va.	5—360
WNAX	Dakota Radio Apparatus Co.,	Yankton, S. D.	100—244
WNJ	The Shotton Radio Mfg. Co., Inc.,	Albany, N. Y.	55—360
WOAC	Page Organ Co. (H. P. Mouse),	Lima, Ohio	50—266
WOAD	Friday Battery & Elec. Co.,	Sigourney, Iowa	20—360
WOAE	Midland College,	Fremont, Neb.	20—360
WOAF	Tyler Commercial College,	Tyler, Texas	10—360
WOAG	Apollo Theatre (Belvidere Amusement Co.),	Belvidere, Ill.	100—273
WOAH	Palmetto Radio Corp.,	Charleston, S. C.	100—360
WOAI	Southern Equipment Co.,	San Antonio, Texas	500—385
WOAN	Vaughn Conservatory of Music,	Lawrenceburg, Tenn.	150—360
WOAO	Lyradion Mfg. Co.,	Mishawaka, Ind.	50—360
WOAP	Kalamazoo College,	Kalamazoo, Mich.	50—283
WOAR	Henry P. Lundskow,	Kenosha, Wis.	50—229
WOAT	Boyd M. Hamp,	Wilmington, Del.	50—360
WOAV	2nd Battalion, 112th Inf.,	P. N. G., Erie, Pa.	50—242
WOAW	Woodmen of the World,	Omaha, Neb.	500—526
WOAX	Franklyn J. Wolff (Monument Pottery Co.),	Trenton, N. J.	500—240
WOC	The Palmer School of Chiropractic,	Davenport, Iowa	500—484
WOI	Iowa State College,	Ames, Iowa	100—360
WOK	Pine Bluff Co.,	Pine Bluff, Ark.	500—360
WOO	John Wanamaker,	Philadelphia, Pa.	500—509
WOQ	Western Radio Co.,	Kansas City, Mo.	500—360
WOR	L. Bamberger & Co.,	Newark, N. J.	500—405
WOS	Missouri State Marketing Bureau,	Jefferson City, Mo.	500—441
WPAB	Pennsylvania State College,	State College, Pa.	500—283
WPAC	Donaldson Radio Co.,	Okmulgee, Okla.	200—360

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WTAJ	The Radio Shop,	Portland, Me.	10—236
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WTAT	Edison Electric Illuminating Co.,	Boston, Mass. (portable)	100—244
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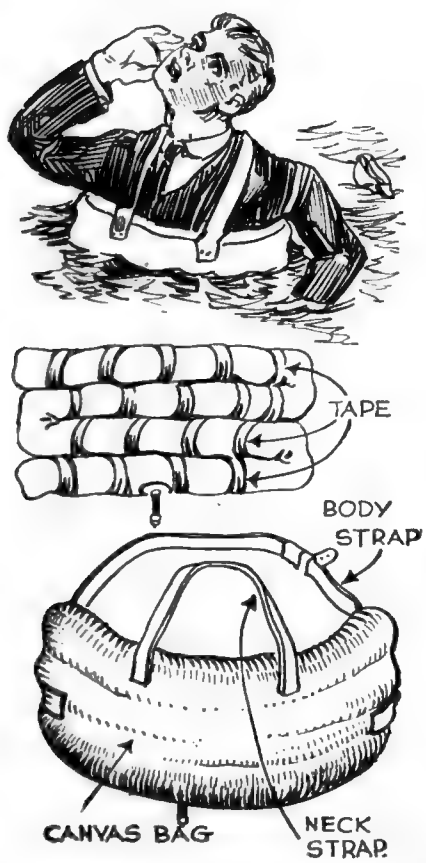
Home-Made Life Preserver



A life preserver that will float even a heavy person can be made from an old automobile tire, even though it has been vulcanized and patched, and is no longer useful on a car. It must, however, hold air. The tube should be cut, not far from the valve stem and each end vulcanized. The tire is now folded back and forth and laced together with adhesive tape, but not tightly, as it will have to be inflated. When inflated, a canvas bag is fitted around the whole. Two straps are then sewed in place, as illustrated.—L. B. Robbins.

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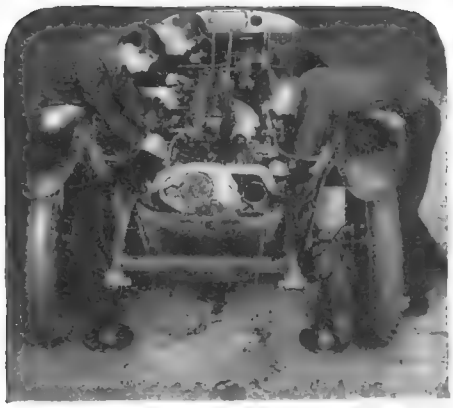

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Answers to Scientific Problems

(*Continued from page* 155.)

THE OIL STREAKS

IN general a good proportion of cars leaving a city have been recently supplied with fresh oil and hence are dripping more freely than are the cars which are entering the city after perhaps a considerable run. As a result, the outgoing cars leave a more prominent streak on the right hand side along which they are naturally proceeding. This fact might help the tourists in the picture to decide which way to turn.

THE RUNNER AND THE DISK

The reaction of the feet of the runner against the disk would set the disk rotating in the opposite direction. Its speed of rotation would not increase indefinitely, however, because as soon as the runner reached a constant speed with reference to the disk he would cease to exert any force which would be effective in turning the disk. By the time he had attained this constant velocity he would have imparted to his body a certain kinetic energy (or energy of motion) and an equal kinetic energy of rotation to the disk. Hence if he stopped running, the energy of his body would just be sufficient to stop the disk also. However, if he pursued a spiral course toward the center before stopping, the energy of the system would be conserved and the disk would continue rotating at a constant rate until stopped by friction. This fact is evident because at the center the runner's kinetic energy would not be effective in stopping it. The opposite of this effect is taking place on the earth, for as the great rivers like the Nile and Mississippi carry their burden of sediment toward the equator they tend to retard the rotation of the earth and lengthen the day. The effect is small, however, and other processes are at work counterbalancing the results of this action.

RISING SMOKE

When smoke rises straight up from a chimney it is because the atmosphere is buoying up the particles of smoke more effectively than when the smoke drifts downward and settles quickly. This means that in general the air is at a higher pressure and therefore at a greater density in the former case than in the latter. Now, as it is well known that a greater atmospheric pressure preceeds fair weather and a lower pressure preceeds foul weather, we see that the behavior of the smoke and the approaching changes in the weather have a common cause.

DRAG CHAINS ON GAS TRUCKS

Particles of dust often convey minute charges of electricity to objects upon which they settle. If this charge is allowed to accumulate on a gasoline truck it may become sufficient to produce a spark discharge perhaps at the time when gasoline is being withdrawn from the tank, thus causing a bad fire or explosion. The drag chain prevents this by removing the charge as fast as it reaches the tank. It is also a safeguard in thunderstorms.

THE TIGHT ROPE ARTISTS

The higher the center of mass of a system above a tight rope the harder it is to keep it balanced. When a man rides alone on a tight rope the man and bicycle are both well above the rope and no small amount of dexterity is required to keep his balance, but when a second person is added whose position tends to lower the center of mass the balancing is much easier.

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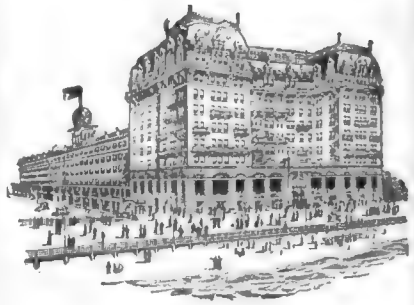

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THE LEAKY STANDPIPE

The streams in the picture are represented as concentric circles. They should be parabolas or curves which become more and more nearly vertical as the stream descends. Then too, the upper stream would not strike the ground so far from the base as is shown for it would be ejected with very little force. From principles of liquid flow it can be shown that the middle stream would be thrown the farthest of all.

BALANCING A BAT

Balancing a bat on the palm of the hand is easier if the light end is next to the palm and the heavy end up, because its motions to the side as it tends to fall over are slower than in the other position and are more easily counteracted. A long stick is more easily balanced than a short one for the same reason. In the first place it is easier to tell when the bat is about to fall over when held in this position, and, in the second place, it is easier to correct its motion than when the heavy end is down. As the bat begins to fall over its center of mass is lowered. This the juggler notices by the slight decrease in pressure of the bat against his hand and he automatically responds with the appropriate movement which will again elevate the center of mass to its normal position. As the center of mass lowers more readily when it is well above the hand, this effect is more noticeable when the heavy end of the bat is up than when it is down. Furthermore, it is highly desirable to have the end with the greater inertia farther from the hand, for then a movement of the hand will be more effective in bringing the end of the bat below the center of mass again.

THE STICK AND THE WINE GLASSES

On account of the rotary action of its two pieces, a stick laid across two wine glasses may be broken before it has had time to respond to the force of the blow.

A QUESTION OF COMPARATIVE INTENSITY

Since the intensity of a sound diminishes as the square of the distance from the source, the intensity of the sound made by the trio of noise makers six feet away may be represented by the number 3/36 and that of the two at a distance of four feet by the number 2/16. Thus it is seen that the disturbance made by the two youngsters would be 1½ times as intense as that made by the three together.

Exercising Bicycle

Athletes and prize fighters will find the exercising bicycle shown above, of particular value. The front wheel is rigidly connected to the frame, and tractive force is applied to this wheel by means or both arms and legs. By twisting the body the rear wheel is caused to swing, and the bicycle steered in this manner. It is claimed that every muscle in the body is developed by this means.

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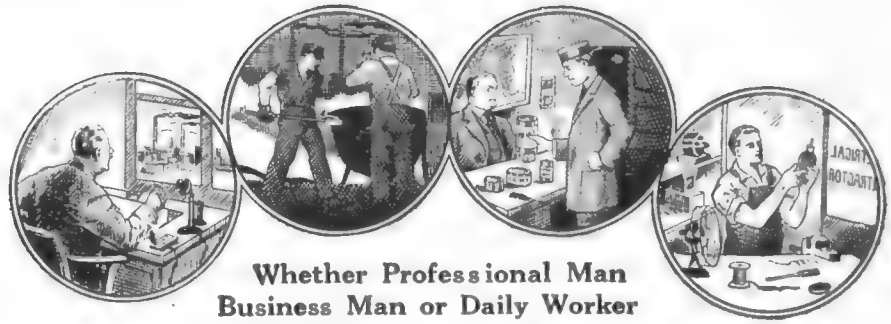

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(No QUERIES ANSWERED THIS MONTH DUE TO MR. MARSHALL'S ARTICLE).

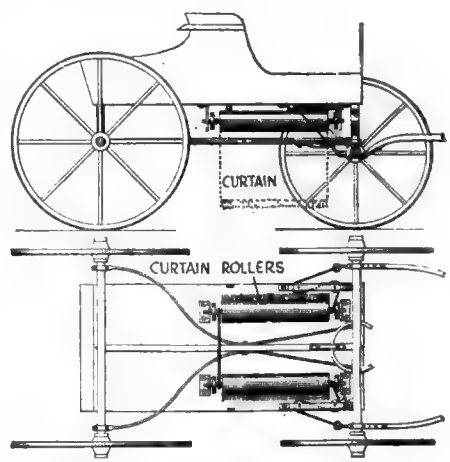
Patents for Inventions

By CHARLES ORR MARSHALL

Patent Department, Toledo Scale Company, former Examiner, U. S. Patent Office

IN the year 1870 an employee of the U. S. Patent Office addressed a letter to the Commissioner of Patents tendering his resignation and stating that he wished to resign because all the great inventions had been made; that the field of invention had been practically covered; and that he did not wish to waste his time in dealing with the few unimportant new things that remained to be discovered. At that time there was no telephone, no incandescent light, no automobile, no radio. The Patent Office has since issued more than a million patents. The young man who resigned because all the great inventions had been made was handicapped by an ingrowing imagination. He did not realize that the realm of invention is unlimited. The field of the known arts may be compared to an area bounded by an irregular line outside of which lies the boundless realm of the unknown. An electrical invention pushes the irregular boundary line of the known arts out at one point, an invention in refrigeration pushes it out at another.

If we add the United States patents granted during the last seventeen years, which are, therefore, still in force, to the applications now pending in the Patent Office, we have a patent right asserted for one person in every city block, with an equivalent quota for the country districts. We find the symbol "Pat." stamped somewhere on nearly every machine, on every car and locomotive, on tooth brush and tooth paste, even on our rubber heels. Everything we use or eat or wear pays its tribute to "Pat."



This patent shows a buggy with curtains on rollers beneath the body which are pulled down like window shades when the front axle is turned. Limbs evidently were modest in 1886.

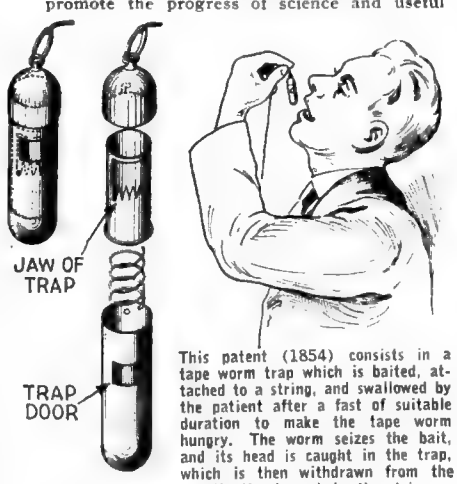
THE PARADOX OF PROMOTION BY REPRESSION

The laws under which these patents were issued are based upon Section 8 of Article I of the Constitution, which authorizes the grant of patents in the following language:

"The Congress shall have power * * * to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

That industry can be promoted and is promoted by granting hundreds of thousands of patents is an interesting paradox. It is a process of encouragement by repression, for a patent is primarily a repressive instrument. It does not, as is generally supposed, give the patentee the right to make, use or sell anything. He does not have the right under his patent to make or use or sell his invention unless he has such right without the patent. If his patented device infringes an earlier patent, he cannot make or use or sell it. If its manufacture, use or sale is contrary to national or state law or to city ordinance, his patent gives him no right to practice the invention. Any circumstance that would prevent him from employing the invention without his patent will prevent him from employing it notwithstanding his patent. In United States Shoe Machinery vs. United States, 258 U. S. 451, the Supreme Court said:

> "From an early day it has been held by this court that the franchise secured by a patent consists only in the right to exclude others from making, using or vending the thing patented."



This patent (1854) consists in a tape worm trap which is baited, attached to a string, and swallowed by the patient after a fast of suitable duration to make the tape worm hungry. The worm seizes the bait, and its head is caught in the trap, which is then withdrawn from the patient's stomach by the string.

Every commercial telephone in use today embodies Bell's fundamental telephone invention. Every commercial telephone in use also embodies Berliner's contact microphone and Edison's carbon transmitter, but though patents were granted on Berliner's and Edison's inventions, neither Berliner nor Edison could have made any use of his invention in a telephone transmitter without permission from the owners of the basic Bell patent. Nor could the owners of the Bell patent construct a transmitter containing the Berliner and Edison inventions without first acquiring rights under the Berliner and Edison patents.

A CURIOUS EXAMPLE OF THE LAW OF SURVIVAL

While patents are primarily instruments of exclusion, the stimulating effect of patent grants

(Continued on page 198)

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CLARENCE A. O'BRIEN

PATENT ATTORNEY

REGISTERED IN UNITED STATES PATENT OFFICE

MEMBER OF THE BAR OF

SUPREME COURT OF UNITED STATES, COURT OF APPEALS DISTRICT OF COLUMBIA,
SUPREME COURT DISTRICT OF COLUMBIA. UNITED STATES COURT OF CLAIMS.

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Patent Advice

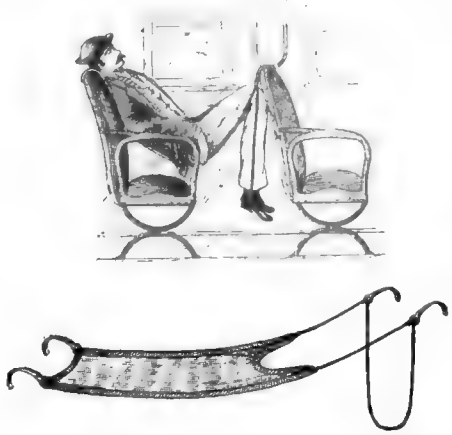
(*Continued from page* 196)

upon industry is beyond questioning. Among modern nations liberality of patent laws and industrial greatness go hand in hand. Among foreign nations Great Britain, France, Germany and Belgium lead, in the order named, in the number of patents granted since 1870. The number granted by the United States during the same period is nearly half as great as the number granted by all other governments taken together.

The development of the patent system in English-speaking countries is a curious example of the operation of the universal law of survival of the fittest. The English kings early adopted the practice of granting monopolies to favored subjects and of selling monopolies for the purpose of replenishing the royal exchequer. They found the sale of monopolies a very convenient form of indirect taxation. When the monopolists raised prices to pay the tribute levied by the crown, the wrath of the people was directed against the monopolists instead of against the monarch. The crown got the feathers without hearing the geese squawk.

These early monopolies were by no means limited to inventions or discoveries, but related to the sale of such common necessities as salt and to such industrial processes as making glass and coke, and to the control of inns and ale houses. Their baleful influence upon commerce and industry, when it was finally understood, made them so obnoxious to the people that the power to grant them was among the first prerogatives that were taken from the kings when their power began to be curtailed. Lord Bacon owed his disgrace largely to an attempt to establish a monopoly controlling the industry of making coke, and Charles the First lost his head principally because of his attempts to make restrictive grants.

The common law courts began holding obnoxious monopolies void long before the enactment by Parliament in 1624 of the Statute of Monop-



The specification of this patent issued nearly 40 years ago states: "The invention has for its object to provide a means whereby passengers who are obliged to travel in ordinary passenger-cars at night may be able to sleep with ease and comfort."

olies, but even at this early time it had been found that the grant of patents for inventions tended to promote rather than retard industry, and the courts, therefore, made exceptions of patents for new inventions and new importations. The views of the courts were stated in the famous case of the Cloth Makers of Ipswich, King's Bench 1615, where the court said:

> "If a man hath made a new discovery of anything; in such case the king * * * may grant by charter that he only shall use such trade or traffic for a certain time, because at first the people of the kingdom are ignorant and have not the knowledge or skill to use it."

When the Statute of Monopolies was enacted, patents for invention were specifically excepted from the prohibition of the statute against the granting of monopolies. Unlike the obnoxious grants that caused the disgrace of Lord Bacon and cost the head of Charles the First, patents for invention take nothing that was before in public possession. If a man make an invention he may keep it locked in his breast forever or he may practice it in secret. It is his by right of discovery. A patent throws about him, for a limited time only, the protection of the law so that he may practice it freely and openly, but it gives him this protection only upon condition that he disclose the invention and thus make it a part of the fund of common knowledge, and upon the further condition that he relinquish it to the public at the end of the patent term.

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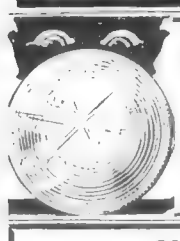

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tection grudgingly given the inventor is little enough. We say to him, in effect: "We will let you keep what is already yours, for seventeen years, provided you will teach us how to make, use and sell it, and turn it over to us at the end of that period, and provided further that you pay the fees which more than cover the cost of our examining the invention and publishing it and that you pay all court costs and attorneys' fees necessary to establish and maintain the rights we give you. If you discover gold or strike oil and sell your claim for a fabulous sum, the amount of your gains that we will take as income tax shall be limited, but if you make a great invention and sell your patent rights for a large sum, you shall pay to us as income tax the greater part of what you have received."

Stingy and hedged about with conditions as the protection given by the United States is, it is liberal compared to that given by most foreign countries, where the patentee is exploited through taxes and working requirements, and the comparative liberality of our laws is undoubtedly a factor in our comparative prosperity.

The inventor's patent may be compared to a seventeen year lease on the acreage that he has added to the public domain. As the law of private property operates to increase wealth generally, by making secure, rights to lands and chattels, so the patent law, by making secure, rights to inventions, operates to increase the sum of human achievement in science and the useful arts. Knowing that he may be protected for a time in the enjoyment of his discovery, the inventor is encouraged not only to explore the unknown, but to bring his finds to the knowledge of all who may be interested.

Encouragement arising from the grant of a patent goes beyond mere encouragement of invention. It stimulates development. The patent is a fence that keeps trespassers out of the field so that the crop may be cultivated to maturity. By compelling others to keep hands off, it enables the inventor or his assignee to devote himself to improvement with the assurance that every increase in the utility of his device will be followed by an increase in his reward.

HOW LARGE CORPORATIONS HANDLE PATENTS

Knowing that protection on new development may be secured, many manufacturing corporations maintain expensive research and development laboratories. The services of the ablest inventors are secured and the inventors are given every possible aid in the way of equipment and are encouraged by means of bonuses and other rewards. Skilled draftsmen and skilled mechanics work out their creations, and many costly models are built and tried for every machine that is placed on the market. The inventions that are thus evolved by highly paid experts working under ideal conditions run in number into thousands annually and constitute a very substantial and important contribution to the progress of science and the useful arts.

The patent system gives impetus not only to invention and development, but to manufacture and marketing. The manufacturer who would hesitate to make the outlay necessary for the introduction of a device which others might duplicate as soon as the market was assured, may undertake the introduction of a well protected, patented device, knowing that others may not reap where he has sown.

The Honorable Elisha Foot, addressing the Patent Committee of the House of Representatives in 1876, said:

> "It is within my remembrance when most of the women were employed in spinning and weaving, just as they were in the time of Homer. * * * Indeed, since the practical operation of the patent laws there has been more advance in the practical arts of life than was made in all the preceding ages of the world taken together."

Without patents it is possible that we should today be without telephones, electric lights and many other conveniences that we have come to regard as necessities, and that such common luxuries as the automobile and the phonograph, if they existed at all, would be crude and expensive curiosities available only to the few.

> "'But on the whole,' continues our eloquent professor, 'man is a tool using animal. Weak in himself, and of small stature, he stands on a basis at most for the flattest soled of some half square foot, insecurely enough; has to straddle out his legs lest the very wind supplant him. Feeblest of bipeds! Three quintals are a crushing load for him; the steer of the meadow tosses him aloft like a waste rag. Nevertheless, he can use tools, can devise tools; with these the granite mountain melts into light dust before him. He kneads glowing iron, as if it were soft paste; seas are his smooth highway, winds and fire his unwearying steeds. Nowhere do you find him without tools; without tools he is nothing; with tools he is all.'"
>
> "A realization of the supreme importance in human life of that unique ability to invent, to 'devise tools,' which has kept the human biped from becoming extinct or from existing but as a furtive and hunted sharer of the forests with the beasts, has been the instigation of patent systems; and no institution of government is more worthy of thoughtful cultivated care." (Journal of Patent Office Society, September, 1919.)

(To be concluded.)

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The Man On the Meteor

By RAY CUMMINGS

(*Continued from page* 131)

Nona was nearest to the tunnel. I flung myself forward to protect her. But just inside our cave Maaret stopped. Her furtive glance swept the tunnel behind her.

Then she turned to me. And her gesture warned us all to be silent!

II

Maaret's voice when she spoke was low, cautious. We listened to her swift words, our hearts pounding with sudden hope. She said she had come to save us! Her motive was clear; we already understood it. Yet she told us it, briefly, and with a direct simplicity that carried the conviction of truth.

Since Og had returned from living in Rax (after his combat with me) Maaret had belonged to him. She loved him. Then had come this woman Nona. Maaret's gaze swept my poor innocent Nona with hatred. This woman Nona, she said, had (with her strange, uncanny looks which Og thought were beauty) won Og from her.

In brief, Maaret wished only that we all—with Nona—return to Rax. Then perhaps she could make Og love her again. Our escape, taking Nona with us, was all she desired.

"Or the death of all of us," Caan suggested. And his look to me was significant.

Maaret gestured vehemently. "That, of course," she admitted frankly. "The black fishes I would set upon you now. But your screams would bring Og. You would not die. I should lose him by that way."

She seemed indeed sincere. She said she could command the black fishes. She would take them away—lock them up. And then we could escape. But we must hurry. It was already the Time of Sleep. At any moment Og would be here.

We consulted; Maaret swam to the mouth of the passageway and gazed anxiously into it.

"Can we trust her?" Caan demanded. "Will she not let us start, perhaps, and then set the black fishes upon us?"

It was possible; and yet we had to trust her.

Atar called her back. "Which way do we go? We will get lost, girl. Will you go with us, until we get to open water?"

She would not. If Og knew what she had done he would kill her. But we could easily find our way. This tunnel led into the main cave. Everyone there would be asleep at this hour. We could slip unnoticed across the cave, up to that ledge and into that other tunnel which was familiar to us. From there we knew our way—through the shallow coral barrier, and up into the open Water of Wild Things.

"A monster may be there at the tunnel entrance," I suggested.

She admitted it, but of that we had to take our chance.

"The girl speaks truth," Atar said suddenly. "I like her. I believe her."

Maaret's smile answered him, but her worried gaze was still on the passageway by which at any moment now Og might arrive.

"We must go," agreed Nona. And then she startled us all. She swam to Maaret.

"You are good," she said. "I would not harm you."

But Maaret shrank away. "You take my Og."

"I do not want your Og."

We were all so relieved at the turn affairs had taken that we found ourselves smiling.

"She is your friend, Maaret," I said. "She loves me—she is my woman—and Boy is our

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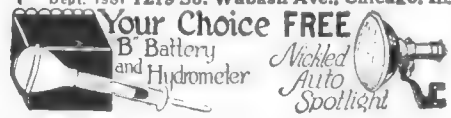

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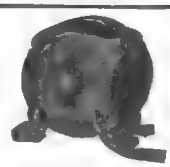

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son. She does not want your Og. She wants only to get back to Rax with me. She wants never to see Og again."

The girl nodded, only half convinced. Indeed, I suppose her attitude toward Nona was only natural.

"Come," Maaret urged. "At any moment it will be too late."

We followed her reluctantly. At our approach the black fishes surged upon us. But Maaret held them in check. They obeyed her low-toned but stern commands. Yet they seemed to sense that something was wrong. Two or three of them dashed at me threateningly. Their low rumbling voices were like the snarls of an enraged dog. In panic, I kicked at them. Then Maaret's command called them off.

We were all in the passageway, in the very midst of the fishes. A side doorway was there—a doorway into a large cage of water. The doorway was barred by a grating. Maaret removed it and began herding the fishes into the cage. They were all in but the last three or four, when abruptly we heard Og's voice from out of the dimness along the passageway! His voice—shouting with surprise and anger. And his figure appeared, plunging at us!

III

Caan shouted an admonition which none of us heeded. Atar dove for Og. I was vaguely aware that Maaret with presence of mind had jammed back the grating into place, locking all but three of the fishes in the cage. I heard her low cry of dismay. Og seemed not to have seen her, and she sank into a shadow by the wall—out of sight.

Then Nona's voice urged me forward. Og and Atar were grappling with each other. Og rasped out an order; and the three black fishes rushed for Caan and me. I struck at one, to keep it away from Nona. The needle teeth of another sank into my leg, and clung. With my bare hands I reached down and gripped the thing by the body. Its black skin was slimy; its teeth in the flesh of my calf were like fire.

Caan, Atar and Og were shouting. The noise would bring help for Og!

"Quiet!" I called. I tried to lunge forward with that thing still clinging to my leg.

Atar and Caan fell silent. But Og's voice rose higher than ever. I did not know exactly what was going on; the water over there was in a turmoil.

Nona was beside me. Her fingers were feeling of the black fish, trying to help me tear it loose. Then I found its jaws; pulled them apart. It lunged away from me. I swung up into the water and looked about.

Atar and Og were still fighting. Caan had shocked two of the fishes into insensibility. Old as he was, he still possessed sufficient power to stun them. The third fish—the one I had repulsed—made for him. I left Nona and dove forward toward Og and Atar. They were circling each other, both trying to get into position to give the electric shock.

Then, from out of the shadows beside them, a figure appeared, lurking there silently. Maaret! I had forgotten her.

Og suddenly gripped Atar by the ankles. I saw that he had Atar almost in the fatal position to receive the shock. But I was too far away to stop it.

OG KNOCKED OUT

I called a warning. But Atar seemed confused. And then I saw Maaret slide silently forward. She kept behind Og, where he could not see her. In her hand she held something white—a heavy shell, or something of the kind. It swung through the water, struck Og on the head. He relaxed from Atar; his unconscious body sank to the floor of the passageway.

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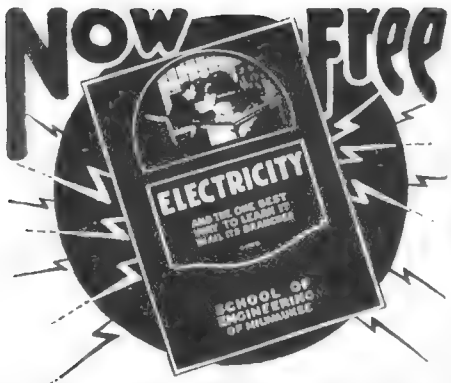

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Caan had by now disposed of the other fish. Atar joined us, panting from his exertions. We were all free to escape.

"Come!" exclaimed Caan. "The cave will be aroused! We must hurry."

Maaret was crouching over Og's stunned body. Her arms were around him; she was crying softly.

"Go!" she said angrily. And ignoring us, she fell to caressing Og. Frightened at what she had done, she was begging him to open his eyes—speak to her—tell her he was not badly hurt.

We hastened away. It was not far to the cave. We dashed into it, recklessly. It was more dimly lighted than when we had last seen it. The main floor was empty. There were family groups in most of the wall niches. Many of them were still asleep. Others, awakened, were looking sleepily about for the cause of the distant disturbance.

We dashed without pause up into the cave. The familiar ledge and tunnel-mouth were easy to locate. The Maagogs saw us. An uproar arose. But before any concerted effort to stop us could be made, we were up across the cave, over the ledge and into the tunnel.

"Safe!" exclaimed Atar. "Hurry!"

There were shouts behind us. But—without Og and the black fishes—we did not fear any of the Maagogs who might try and follow us.

We were soon through the coral barrier. Another few moments and we were at the main tunnel-mouth. The open Water of Wild Things stretched above us. For a moment we hesitated, looking cautiously up there. But no monsters were in sight.

"Soon we will be in Rax," I murmured exultantly to Nona. And her loving arms went around me.

Caan was looking back down the passageway. "Nemo, you hear that?"

WE ARE FOLLOWED

Our blood ran cold. In the distance, back toward the cave, we could hear those horrible yelping cries! Og had recovered! He had let loose the black fishes upon our trail! They could outswim us. We could not hide from them. And this time when they caught us, Og would not call them off!

There was nothing to do but try and get across the Water of Wild Things before we were overtaken. The way before us was open. Every second we hesitated made our chances less.

We plunged up into the black void. Swimming in couples, Nona and I followed Caan and Atar. They led us close along the sea-bottom. Coming in, Caan had been careful to remark the lay of the bottom so that he could find his way back.

We swam fast, too fast for talking save an occasional monosyllable. Behind us we could hear the cries of our pursuers. Growing louder, steadily, but slowly. It was a stern chase, and if we could hold our present speed—a long chase.

On we swept, just above the sea-bottom. Occasionally giant crabs would scuttle away from us, alarmed by our swift movement. To the sides, lights sometimes showed—the lighted heads of monsters. But none came near us. A thing all spines drifted past; but it did not molest us. A giant clam, larger far than any one of us, was lying on the sea-bottom in our path. It opened its shells as though hungrily to suck us in, but we avoided it.

We came at last to the side wall of the black void of water—the wall alongside of which we had descended. Up there, a few thousand feet, lay the entrance to the Marinoid domain. If we could get into that entrance—into the coral forest before the black fishes caught us. . . .

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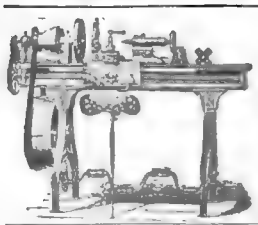

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We swam upward, along the line of wall, a few hundred feet off. Directly beneath us now, following every twist of our trail, the pursuing fishes were yelping. They were much closer. And Nona was tiring! It was the longest, most sustained fast swimming she or I had ever attempted. Atar and Caan were drawing away from us. They did not realize it, and I did not call to them. Perhaps, if we two gave out, they could go on and save themselves.

Then Caan looked back. They slackened their pace and we caught up with them.

"Go—on," I panted.

But they would not go faster than we could go. And we all knew that very soon now we would be caught.

We were perhaps two-thirds the way up the wall when suddenly Caan and Atar swung sharply out to one side. Nona and I followed, as one fish follows the turns and twists of another. I looked to see what was wrong. Overhead, directly in our former path, loomed the black, unlighted bulk of a giant monster, huge and fearsome beyond anything we had ever before encountered!

IV

We had no time to decide what we should do. The monster saw us. It swung toward us. Beneath us—almost in sight now—the black fishes were mounting. And further below them—dim and muffled in the distance—we heard Og's voice shouting a shrill command to urge them on.

We darted out sidewise, away from the wall. Atar was leading, and single-file, we others followed. Then Atar turned suddenly and doubled back upon himself. Strung out in a line, we turned with him. Making straight for the jagged cliff-face, we passed close under the monster, between it and the mounting black fishes.

The monster was slow, ponderous in its movements. It was coming down, and as we darted under it I stared up and saw it plainly. A gigantic black thing. A spherical head, twenty feet broad; a thick, elongated body—a hundred feet or more in length. There were no fins, and no tail. The head had two great protruding eyes, gleaming green, and beneath them a circular mouth—a mouth which even undistended was large enough to suck in our bodies. And around the head, fastened to it—framing the face—were a dozen arms! They were waving tentacles with a sucker disk at the end of some, and a hook at the end of others.

A squid! you perhaps explain. It was, indeed, fashioned somewhat after the plan of the squid of your earthly waters. Let me call it then, a squid. It came down ponderously, waving its tentacles and floundering with its unwieldy body.

Avoiding it, we struck the cliff-face. A depression was there—a sort of ledge. On it we huddled, panting; Nona and I were almost exhausted.

"We must go on!" Caan whispered. "The black fishes—they will find us. And that giant thing—it can suck us up——"

But Atar silenced him. Atar knew what he was doing. And most of all, this momentary inactivity was allowing Nona and me to rest. We could not have gone much further in any event.

The giant squid had swung awkwardly to follow us. Then evidently it heard the yelps of the uprushing fishes. It hesitated, turned downward; it was below us, and out from the wall, but still in plain sight; and we saw the black fishes sweep up to attack it.

THE MONSTER DRAWS OUR ENEMIES

On every side the monster was assailed. There must have been two hundred or more of those ugly, squat little things. The bulk of the squid dwarfed them into insignificance; but like bull terriers worrying a prostrate elephant, they tore at it.

The Road to Home

Though written faithfully, his letters from home seemed to have had a way of arriving at his hotel in one city just after he had left for the next—and of never catching up.

Three weeks passed—business conferences, long night journeyings on sleepers, more conferences—with all too little news from home.

Then he turned eastward. In his hotel room in Chicago he still seemed a long way from that fireside in a New York suburb. He reached for the telephone—asked for his home number.

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The squid floundered. Its lashing tentacles hooked the fishes and flung them away. Its mouth sucked them in and swallowed them. But scores of the fishes gripped the tentacles and clung; others bit and tore at the soft, puffy flesh; still others swarmed at the monster's protruding eyes, gouging them. . . .

The squid was in distress. It pulled itself to the wall below us and clung with its suckers. Then it let go, and ejecting a great stream of water from its mouth, forced itself swiftly backward. But the swarm of fishes still tore at it. One of its eyes went out. Its lacerated flesh gave a stench to the water that sickened us. . . .

Caan was plucking at me. "We must go—now while we have the chance. Og may call his fishes—set them on us——"

Where was Og? I had forgotten him. He had fled, doubtless. Then we heard his voice. He was hovering off in the open water; we heard him screaming angrily to the fishes, trying to call them off the squid—to set them again on our trail.

We started upward, close to the cliff-face. Og would not see us perhaps.

"Faster!" urged Caan. "We swim like children."

Atar again led us in single file. I was last, swimming just after Nona. I turned to look downward. The squid was lashing the water in desperate fury. The fishes, many of them, were floating downward—inert. But many others, ignoring Og's commands in their lust for blood, were still attacking. I saw Og now, well off to one side. A dozen or so of the fishes were gathered around him.

The water down there by the squid was lashed white. It caught what light there was and I could see everything plainly. Then, as the squid rolled over with a last despairing effort, I saw a great stream of inky black fluid issue from it. The ink spread. Everything turned to blackness. The squid, as a last desperate measure, had emptied its ink-bag and under cover of the darkness was trying to escape. The water down there was a bowl of ink, out of which came the snarls of the fishes, and Og's shrill voice shouting commands.

We mounted swiftly, for Nona and I were refreshed by our brief rest. Soon we were within sight of the horizontal slit in the cliff—the entrance to home! But again beneath us, we heard Og's shouts and the deep-throated cries. They were after us.

Atar, leading us, abruptly stopped. My heart leaped to my throat. Was it another monster ahead? It was something. There was something sweeping toward us! Not slowly, ponderously this time—but swift almost as a thrown spear! From up near the horizontal passage we saw it coming—small, a dim blob at first, with a little V-shaped white wake behind it. Larger, closer—a few seconds only, while we huddled together, wholly confused.

Turning in an arc, this new thing swept at us—slowed down its flight, and stopped beside us. We shouted with the relief of hysteria. It was our Marinoid King—Atar's father—alone in his sleigh, driving his dolphin-like animal which could pull it faster than any of us could swim.

We were safe!

V

Into the sleigh we climbed. Nona sat in the seat beside the king. Og and his black fishes were approaching; but we were away, gliding through the water with a speed that soon out-distanced them.

The sleigh itself was constructed to be slightly heavier than water, so that it could glide along the sea-bottom. But now it was bouyed by tiny air-pods fastened to it, so that of itself it would neither float nor sink. We darted away after no more than the

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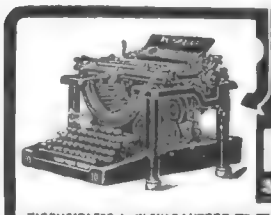

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briefest of greetings with our king. We three men clung to the rim of the sleigh behind. Its rapid motion threw our bodies out horizontally, like men clinging to the tail of a speeding aeroplane in the rush of air.

Never before had I moved through water so fast. It roared in my ears, blurred my sight, and choked me. Dimly I saw the passageway speeding past beside us. We were paralleling it; not entering, but heading for its further end.

Then we seemed to go still faster. I coughed, choked. The press of water against my mouth stifled my breathing. My lungs were full and I could not exhale. I heard Atar's voice—a shout: "Nemo—your arm—put it—before your face! You——"

The rushing water tore away his words. But I understood. I clung with my right hand to the sleigh; with my left arm crooked before my face, in the back-eddy of water behind it, I breathed again. And then I saw that all the others were doing the same. Had I not done it, I should have been drowned—as *you* perhaps have choked a fish to death by towing it rapidly through water.

We dashed onward, with the water roaring past. Then in a gentle arc we swung to the left and slackened to normal swimming speed. A mud-ooze floor was close under us; a ceiling came down overhead. We were in the slit, headed for the coral forest. The coral barrier! I gasped as I thought of it. How had the king come through that barrier with his sleigh?

I was now crouching, clinging to the sleigh at Nona's side. I asked the question, but no one heard me. They were all talking.

The king had an arm about my Nona, paternally, affectionately. "I am glad you are safely returned, my child."

Atar was asking: "My father—what made you come for us?"

The king answered very gravely: "Your mother—she was worried, Atar." His eyes were laughing. "I had to slip away, unseen in the Time of Sleep. Our people would not like their monarch dashing off alone to possible danger. But though I am an old man, there is lust for fighting in me yet."

Then I made my question heard. The king sobered instantly.

STRANGE HAPPENINGS

"Much is coming to pass in Rax—strange things I learn every hour—and all of danger to us and our people."

He told us then that upon the heels of our own departure into the Water of Wild Things (it had been two eating times before, as I well knew by the hunger which possessed me) the Marinoid guards had noticed an open swathe cut through the coral forest. They found it, and reported it to the king—a thirty-foot-wide lane. Evidently it had been recently done by the Maagogs. In our own hasty search for an entrance, we three had overlooked it.

The king, hearing that, had decided to drive a short distance into the Water of Wild Things and look for our return.

As he spoke, our sleigh reached the coral forest. We passed along it a short distance, and arrived at a grating thirty feet square. The situation was now plain to us, and hastily we told the king what we had learned from the Maagogs. Og, sure of the coming war and his own leadership, was preparing to strike at once. He had had this lane cut through the coral to give free passage to his Maagog army in its attack on Rax. This grating Og had put there to keep the monsters from wandering into Marinoid waters. He was going to conquer those waters—and he wanted no monsters there to harass the future of the victorious Maagogs.

The grating was easily removable. The king had swung it aside to get his sleigh past; and we swung it now, to return. Soon we

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were speeding out across the cool, sweet Marinoid waters. They were dim with twilight. Peaceful, beautiful, a Garden of Paradise to us, returning now from that foul Water of Wild Things.

It was still the Time of Sleep in Rax when we arrived. Quietly, unobtrusively, we slipped unnoticed into the city.

And Nona was again with Boy! The joy of it! I am a mere man; I cannot describe—I know I cannot even appreciate—how my Nona felt to hold Boy again to her breast; to feel his baby arms about her neck; to hear his gleeful, welcoming cries. Only a mother can understand; and I, a man, could but stand and watch, and wonder.

VI

You wish to hear more? You must be patient, for I can tell you but little more just now. The next three days in Rax were full of danger and disaster for us all—stirring, critical days when the very empire of the Marinoids trembled in the balance. I shall not describe them now—of them you shall hear presently. Smouldering fires of hatred and jealousy which for years had lain dormant among the Marinoids now broke out—under Og's insidious activities—into flames of passion and the lust to kill. I had known of no such condition; even Caan had no more than vaguely suspected it. But the king knew it. Atar knew it; and in their fullest confidence now, you shall hear how during those next few days we tried to avert a catastrophe.

CATASTROPHE

But catastrophe came. The half-breed revolt broke out in Gahna—a sister city to Rax—fairest, most beautiful city of all—and nearest to the entrance to the Water of Wild Things. The half-breed revolt, coming when we were on the brink of a foreign war! The slumbering Maagog cancer in that Marinoid civilization which I had thought so peaceful!

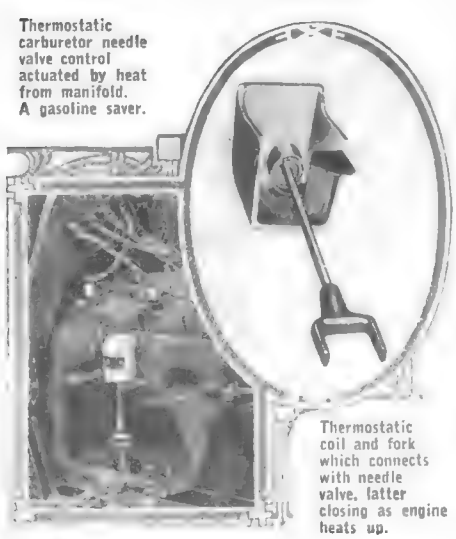
We three—the king, Atar and I—hastened in our sleigh to Gahna. It was more than a revolt! A massacre! The waters of Gahna were running red! The sea there for miles around was tinted rose. The light inherent to the water caught the rose-tint—reflected it with a myriad gradations of beautiful color.

Helpless, we hung poised in our sleigh, watching. The red tinge was spreading everywhere. Blood of our Marinoids! And yet in my heart, I knew then it was only the presage of more terrible times to come.

END OF PART VI

Thermostatic Carburetor Control

Thermostatic carburetor needle valve control actuated by heat from manifold. A gasoline saver.



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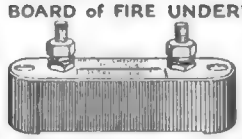

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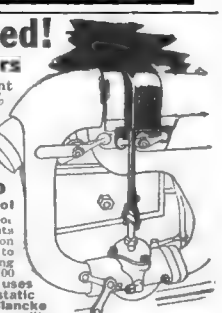

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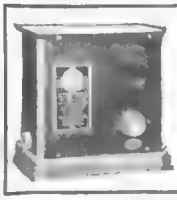

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RADIO WRINKLES

EDITED BY
A. P. PECK
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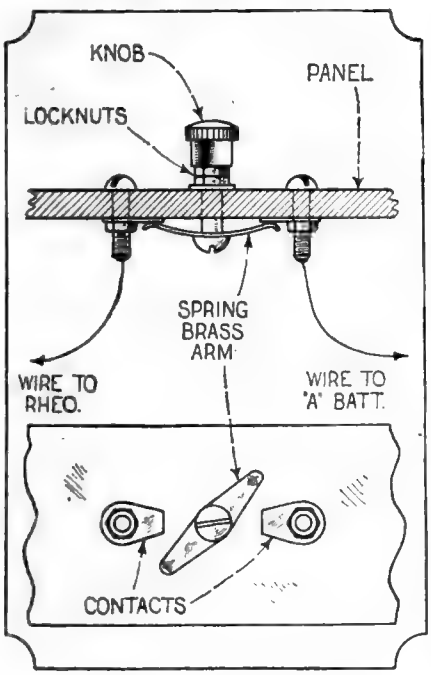
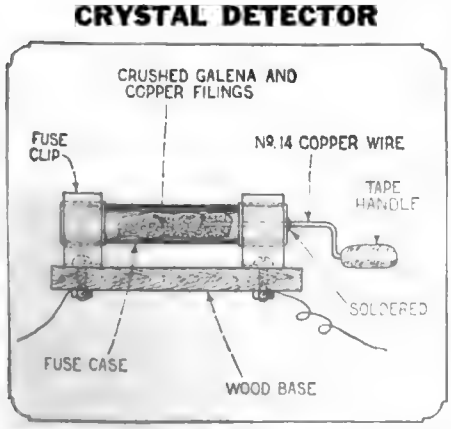
UNDER this heading we are going to publish items of interest to everyone who likes to build radio instruments. In order to continue this department it is necessary for our readers to tell us about their latest experiments. Write us a short description of some time- or money-saving kink you have discovered and send it to us along with a few sketches. Our regular prizes will be paid for this material. Be brief and try to put everything in the drawing. Don't be too elaborate. Address "RADIO WRINKLES" editor care of Science and Invention.

BATTERY SWITCH



For breaking the "A" or the "B" battery circuit, a switch such as illustrated above is very convenient. It lends itself very well to panel mounting and presents a neat appearance. The contacts and the rotary arm are both cut from spring brass and the switch arm is bent as shown. It should have sufficient tension to keep the two lock nuts under the knob firmly against the washer which is between them and the panel. It will be noted that the parts of a well known variable grid leak may be used for constructing this switch.
—Ralph E. McAdam.

CRYSTAL DETECTOR



To make this simple adjustable crystal detector, clean out the inside of a fuse and fill it with a mixture of crushed galena and copper filings, using more crystal than metal. Place a short piece of No. 14 copper wire as shown and solder to the cap. Mount the fuse in a standard mounting, whereupon the crystal detector may be adjusted by turning the handle very slowly. A buzzer test should be used.
—Walter T. Markowski.

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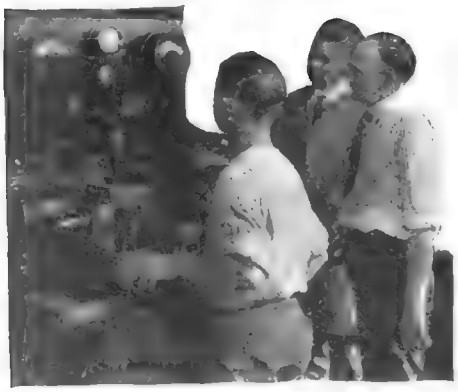

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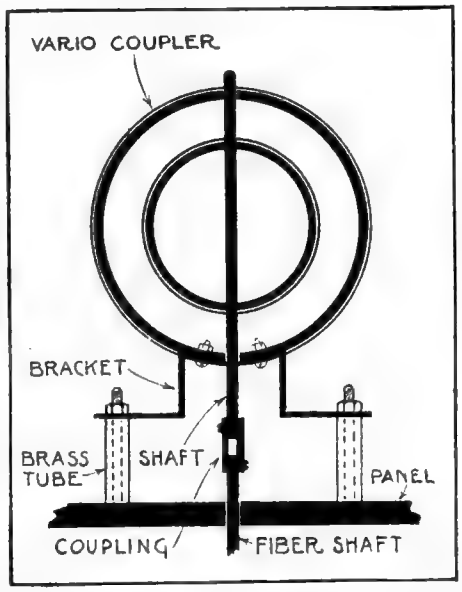
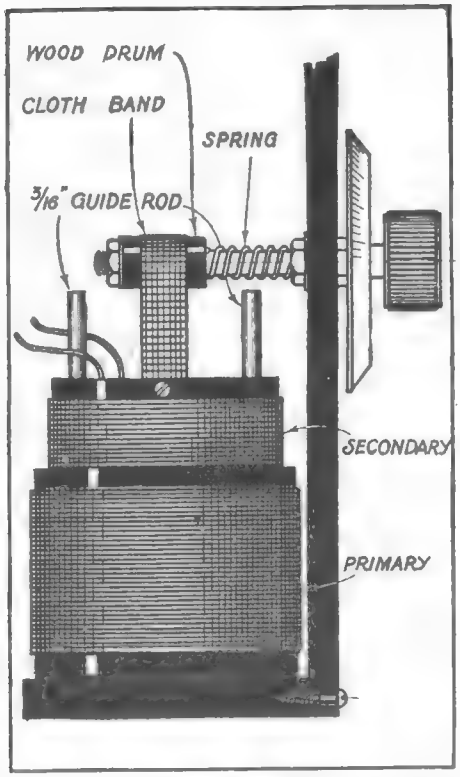
COUPLER MOUNTING



It is often desirable to mount a vario-coupler at a distance from the panel so as to eliminate body capacity. This is particularly true in the case of circuits employing tickler feed-back where the rotor of the coupler is used as a tickler coil. To get away from this extremely annoying effect, the vario-coupler mounting illustrated above may be used. A bracket of strip brass is constructed and fastened to the stator of the coupler by means of two machine screws. Two long brass machine screws and two pieces of brass tubing about two inches long are then used to fasten the bracket to the panel; at the same time holding it some distance from the same. To further decrease the effect of the capacity of the hand on the coupler, a coupling is employed and a fiber shaft brought out from the same through the panel. The dial controlling the rotor is then fastened to the fiber shaft. —Mahlon Adams.

LOOSE COUPLER CONSTRUCTION



The old type of loose coupler employing a secondary wound on a straight tube still has many adherents but in its usual form it does not lend itself very well to mounting on a panel. An excellent suggestion has been put forth by one of our readers to overcome this difficulty and our illustration above shows the method. The secondary of the coupler is mounted on wooden ends and holes are drilled through the same to allow the passage of two guide rods. A wooden drum is then mounted on a brass rod which passes through the panel and has a knob and dial attached to the other end. A spring keeps the drum from revolving when the secondary is withdrawn from the primary when the knob is released. —Madison Walraven.

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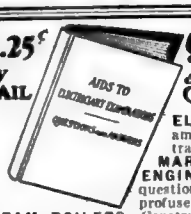

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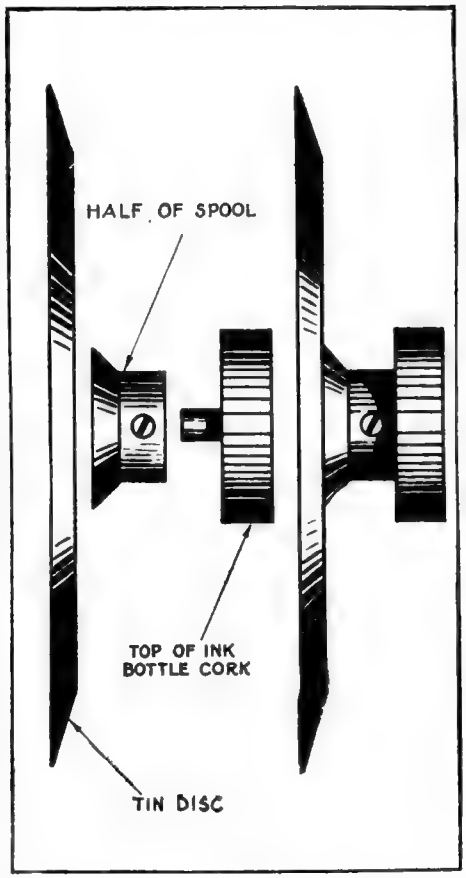
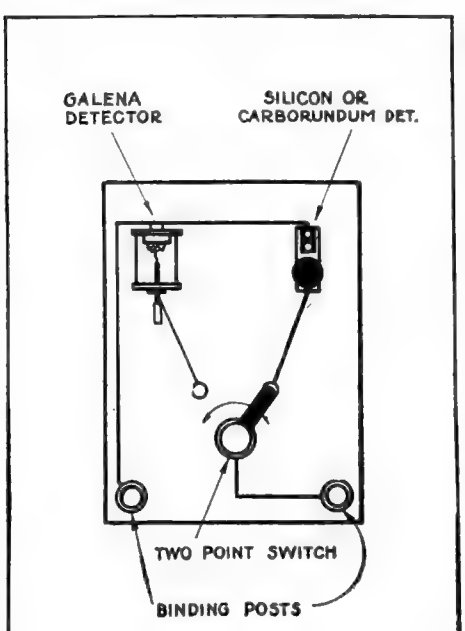


Quite satisfactory home-made dials may be made by following the above illustrated suggestion. Cut a disc of metal from the bottom of a round tin can. On most cans this disc will be found to have a bevelled edge as shown above. Next obtain a spool and cut it in half and then get the top of an old ink bottle. Cut it as shown and assemble with glue and wood screws. A hole may be drilled through the disc and a set screw provided in the spool for holding a shaft. —W. R. Adams.

DUPLEX DETECTOR



If two detectors are mounted on a base with a two-point switch as shown above, one of them can be used when the other is out of adjustment. A carborundum detector stays in adjustment very well and acts as a stand-by to be used when the sensitive galena detector is accidentally knocked out of adjustment. —Leroy Western, Reporter No. 15.

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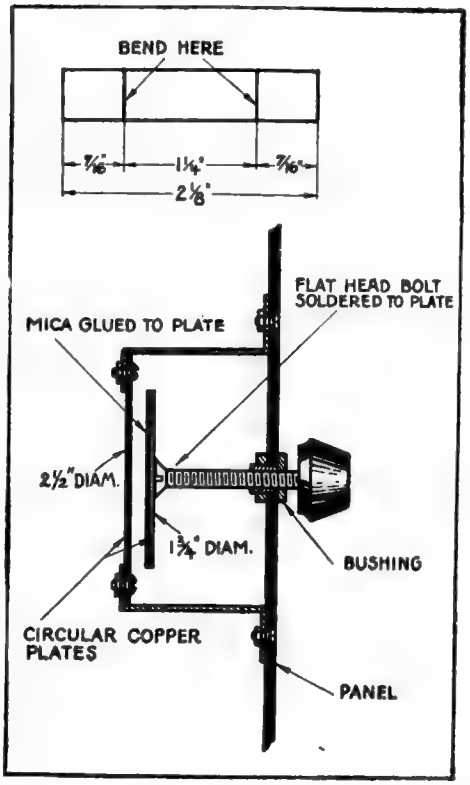
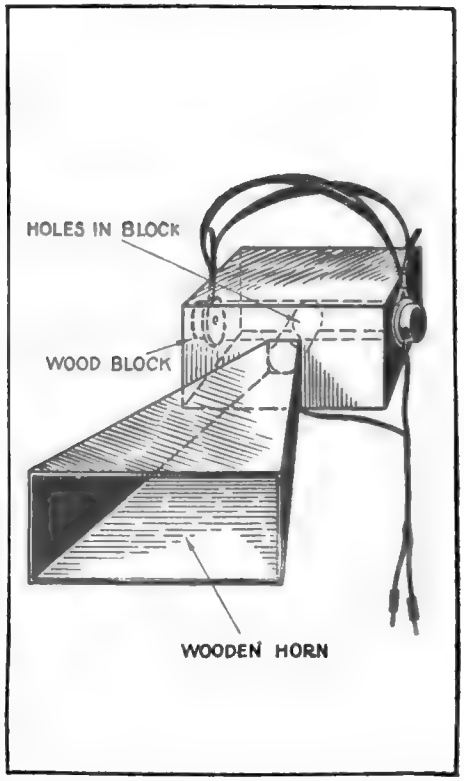


To make this variable condenser, first cut two discs from sheet copper, one 2½ inches in diameter and the other 1¾ inches. Solder the smaller one to a flat-head machine screw and to the other side cement a disc of mica, as shown. Assemble as illustrated, using two brackets such as those shown at the top of the above drawing. —H. F. Loeffler.

LOUD TALKER



A very simple loud talker may be made of wooden parts as shown above. Two holes are drilled in the wooden block, one all the way through and the other at right angles to it and meeting it at the center. A wooden horn is then attached as shown, and a pair of ordinary receivers clamped over the holes in the side of the block. —George W. Moore.

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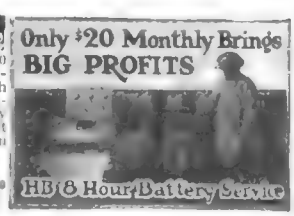

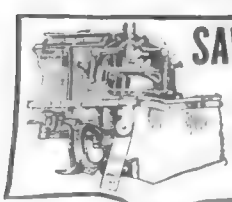

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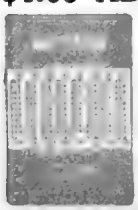

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The Heavens in June

By ISABEL M. LEWIS, M. A.

(*Continued from page* 144)

one will find countless small nebulae, apparently closely packed together yet probably at distances of many light years apart and at enormous distances from the earth, it is believed, though very little is known of these strange objects. Many of them are small spiral nebulae though it is not known that all of them belong in this class. This part of the heavens is farthest from the Milky Way and it has been suggested that these small spirals may be in some way repelled by the Milky Way as many of them are known to be rapidly receding from it.

Coma Berenices, or Berenice's Hair, which has the appearance of a misty veil of light, is in reality a coarse cluster of luminaries consisting of a number of fifth and sixth magnitude stars and many more which are just beyond the reach of the unaided eye but which can be readily seen with an ordinary opera glass.

According to the story this constellation represents the lovely tresses of Berenice, wife of king Ptolemy Euergetes, who reigned in the third century B.C. As the king was departing on a dangerous expedition against the Assyrians, Berenice vowed that if he returned in safety she would dedicate her amber tresses to the goddess of beauty. And so when the king came home victorious the hair was placed in the temple of Aphrodite from which it was stolen shortly afterwards. Conon, the court astronomer, then announced to the grieving king and queen that the tresses had been taken by Jupiter and hung in the heavens, pointing in verification of his word to this constellation, which it seems had been unnamed up to this time.

Boötes which lies next to Coma Berenices on the east and which we can easily distinguish by its resemblance to a boy's kite and by its brilliant Arcturus is generally called the Herdsman, though the name means literally Ox Driver. This is the more suitable name as he is supposed to be driving the seven plow-oxen, the stars that form our familiar Big Dipper.

According to Hevelius, however, a Polish astronomer who lived in the seventeenth century, Boötes was a hunter pursuing Ursa Major, the Greater Bear accompanied by Asterion and Chara, his two hounds which are represented by the two brightest stars in Canes Venatici, the Hunting Dogs, lying to the north of Coma Berenices. Modern star-maps that picture these forms that the ancients saw in fancy in the heavens follow Hevelius in representing Boötes as a hunter.

Arcturus was known to the Arabs as The Lance-bearer and was also, in early times, the spear held in the hunter's hand. Its name which was given it by the Greeks means, however, Bear-guard. It is well to remember that Arcturus can be found by prolonging the line of stars in the handle of the Dipper or the tail of the Bear, whichever we prefer to call it. This furnishes us with an easy method of identification of this gorgeous orange-colored star which is one of the brightest of all stars and one of our nearer neighbors among the stars being at most not over thirty-five light years distant from the solar system. At this time we will find on the meridian the large equitorial triangle which has at its vertices Arcturus, in Boötes, Spica in Virgo and Denebola, the second magnitude star in the tail of Leo.

Though the summer evening skies are far less brilliant than those of winter, we find a number of first magnitude stars above the horizon at this time, and in addition the three planets Saturn in Virgo, Venus now low in the northwest in Gemini, and Jupiter, the golden-hued giant of the solar system, not far from fiery Antares now appearing in the southeast.

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Dr. Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(*Continued from page* 133)

"Those are our escort," explained Doctor Hackensaw. "They will follow us across the Atlantic in order to be ready to help us in case of emergency. It would be too dangerous otherwise, for the slightest accident to our machine would mean death, if there was no one at hand to pick us up."

RELAY SYSTEM

"Will they follow us all around the earth?"

"No, indeed. They will leave us at Paris, and there three extra planes are waiting for us, to carry us on to Cairo where a new relay will be in readiness. I had about fifty planes ready to sell to the government, so I sent half of these ahead on this route to wait for us, and the other half I sent in the opposite direction over the Pacific, to establish relays in San Francisco, Hawaii, Japan and China."

The Hoochie and her consorts soon reached a speed of one hundred miles per hour, then two hundred, and finally climbed up to three hundred. A wireless telephone had been installed on all the machines, so the occupants could talk together sociably.

Everything went along swimmingly, but, as Doctor Hackensaw was wont to remark, "there is only one sure thing in this world, and that is 'trouble.'"

In order to attain greater speed, the doctor had risen higher and higher, and now his instruments indicated that he had reached an altitude of ten miles—about double the height of the highest mountain. There was a great advantage in so doing, for at high speeds the resistance of the air is considerable. As the doctor explained to Pep: "The resistance of the air increases as the square of our velocity while the power of our propellers in the rarefied air only diminishes as the density of the air. Consequently there is a great advantage in flying high."

"But," objected Pep. "You have to climb ten miles up and ten miles down every time you land.

"True, but as we land only eight times, this makes only 160 miles extra to go—not even that,—because we rise and descend on the diagonal. It would pay us to travel at an altitude of twenty-five miles, and I'm going to try it."

Even this rate was too much, for scarcely had the instruments in the Hoochie registered two thousand miles travelled from New York when an alarm-signal came from one of the attendant planes, and this was followed by the message:

"Something has gone wrong. We are falling!"

Doctor Hackensaw at once ordered the second plane to turn back and fish up the occupants in the crippled plane. Then he added:

"When you have saved the men, don't bother about the plane. It will probably float. Follow straight after me, as I may need help before I reach Paris. We can send some one back from there to save or destroy the wreck."

To Pep the trip was somewhat monotonous. At a ten-mile altitude there was nothing to see, not even a cloud in the heavens. All was an inky black sky and bright sunlight.

An hour or so later, the attendant plane caught up with them again, bearing the occupants of the No. 3 car, whom they had literally fished up from their falling plane.

The rescuers had hovered over the wrecked plane as it descended, and had let down a rope ladder, provided for just such emergencies. The wrecked men, encased in helmets

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to protect them in the rarefied air, had climbed up to safety one after the other, long before the wrecked plane had fallen a single mile of the ten miles to the ocean level.

The rescuers had then put on an extra burst of speed in order to catch up with the doctor.

About eight o'clock P. M. by the doctor's watch, both machines landed at the aviation-field in Paris. Here a few minutes' stop was made to take on fresh supplies of gasoline and oxygen and to make a careful inspection of the machinery of "The Hoochie" Everything seemed in such good condition that the doctor decided to keep the same machine for the next stage of the journey. He also kept the rescuing plane and the three new planes he found waiting for him; for experience had shown him that a single accident would deprive him of his escort. With four attendant planes, he could continue his route even if two accidents occurred, a rescuing plane being left behind in each case.

CHAPTER III

From Paris to Cairo the journey was made mostly during the morning hours as noon on the trip occurred several hours earlier than noon in New York. At the Cairo landing, the doctor in his pajamas turned out of his berth, made a rapid inspection of the machinery and decided that the Hoochie was good for another lap. Three new planes were awaiting him here, and these, with the best of the other planes, made a new escort of four. A glance at the instruments showed that the average speed made during the last lap was very nearly four hundred miles per hour. If the trip continued in this fashion, the tour would really be too easy. But Doctor Hackensaw well knew by experience, that the average speed made during the last hour, was to be no exception to the rule.

That morning the doctor and Pep had remained late on their couches. Even so, the day was long, though they tried to while away the time by playing cards and dominoes.

When they reached their stopping-point in India a dilemma arose. The Hoochie, which had so far behaved beautifully, began to show signs of the strain. Either the machine must be abandoned, or a stop must be made to overhaul it. The doctor was now two hours ahead of his schedule, and he was so desirous of making the entire trip in the same car, that he decided on the second alternative. He compromised matters as follows: three new planes were waiting for him here, and in one of these he sent Pep on ahead, with instructions to wait one hour for him at the next stop, which was in China. In case he failed to appear, she was to complete the tour alone. Two good planes would accompany her, and two would remain with the doctor.

Pep was delighted with the arrangement and inwardly hoped the doctor would be delayed. What a triumph it would be to be the first person who had circumnavigated the earth in an airplane!

THE ACCIDENT

The plan seemed a wise one—as it doubled the chances of success. Unfortunately, however, Pep was young and enterprising and not over-obedient. She had strict orders not to exceed a speed of three hundred miles per hour, and for the first two hours she allowed the pilot to keep very close to this figure. Then she gradually increased the speed until the four hundred mile limit was reached. Even that didn't satisfy her. After a couple of hours at this speed, she demanded even more power, and the pilot, a young fellow, nothing loath to show off the capabilities of his machine to this pretty young girl, put the speed up to the highest notch, obtaining a record of over four hundred and fifty miles

(*Continued on page 215*)

Is *This* Why the Boss Laughed When *You* Demanded Bigger Pay?

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The Perfect Man

DID you notice how The Chief gave you the "once-over" . . . "up-and-down" . . . taking you in from top to toe? He was getting your number . . . taking your measure . . . deciding in his own mind just how far he dared to go with you.

Then He Turned You Down Flat! He knew he had you licked before you started. And there was scorn in his eyes, a sneer in his voice, a sting in his words of refusal. You were in the right and he was wrong . . . but he bluffed and bullied you out of what belonged to you. And why? Simply because he knew that . . .

He Was a Stronger Man Than You! Not just because he was your superior in position but because he was your master in the stern, rugged qualities of dominating manhood. He had stronger nerves, a clearer head, greater daring and more fighting force than you ever dreamed of owning. AND THAT'S WHY HE'S THE BOSS AND YOU'RE THE MAN THAT'S WORKING FOR HIM.

One Thing He Never Could Laugh Off, Listen, my friend. What do you think would have happened if you had shouldered your way into that bird's office with your proper fighting weight of clean, hard muscle . . . with a cold glitter in your clear eye . . . with the fine upstanding posture of a man to whom fear is only a word in the dictionary? Would he have laughed that off do you suppose? Not on your tintype, my friend . . . not on your life. He'd have given you the raise you asked and apologized for not making it a bigger one.

If I Were You

I'D MASCULARIZE INSIDE AND OUT. I'd energize and I'd STRONGFORTIZE until every muscle on my body was rippling with joy and every organ inside of me was hitting on all six cylinders. I'd win a digestion like an ostrich and a vitality like a tiger's. I'd gain white nerves and clean limbs and strong lungs. Then I'd step on the gas, blow my horn and tell the world to look out because I was on my way

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"What!" cried Doctor Hackensaw, struck with a sudden idea. "If their God here told them to release us, would they do it?"

"Of course they would! Immediately!"

"All right, then! Just step into the airplane with me, Mr. Lamb. For the time being, you are to act the part of Buddha. I want you to make a phonograph record in Chinese. I have here some wax blanks, and when Buddha's commands are uttered through a loud speaker, I feel sure these poor Chinese will be convinced it is their God who is talking to them."

"What shall I tell them?"

"I'll coach you." And as Doctor Hackensaw spoke the words, Mr. Lamb translated them into Chinese and enunciated them slowly and distinctly into the instrument. The rest was but child's play. Doctor Hackensaw had with him, already engraved, some records with artificial thunder, the roar of cannon and musketry and all kinds of unearthly noises. For convenience in experimenting, his phonograph could take several disks at once, each with its own needle, and by shifting a lever, any one of the records could be switched on in place of the other. This was to facilitate the study of the combination of different sounds and so analyzing the engraved grooves on the record.

Everything being in readiness, Doctor Hackensaw, through his interpreter, informed the natives that he was under the special protection of their God, Buddha, and that Buddha himself would confirm this.

"BUDDHA" SPEAKS

A hush of awe fell over the hundreds of spectators by this time assembled. Then Doctor Hackensaw adjusted his loud talker and set the phonograph going.

The record opened with loud claps of thunder, and the roar of artillery, accompanied by hideous noises of all kinds. Then came a loud, gruff voice apparently from the heavens above:

"People of China, listen to me! These strangers are men from the sky. They are special friends of mine, and any one who harms a hair of their heads, will be cursed! He will perish miserably with all his family, and their graves will be defiled! Let these men go in peace, or I will destroy this whole town with thunder and lightning! I have spoken!"

Then came another burst of thunder and artillery, and all was quiet again.

The effect of the speech was magical. A hundred eager men came forward to loosen the ropes, and as the disabled plane had by this time been put in order again, the airplanes soared aloft. Doctor Hackensaw, however, had taken Pep on board with him, so as to prevent future trouble. Needless to say, Mr. Lamb went with them.

They had to make another stop in China for their supplies, and still another in Japan before starting for the long flight over the Pacific. They had reached Japan at noon by the Doctor's watch, but in reality in the early morning by Japanese time, after an all-night ride. They had to put on extra speed to make up for lost time, and on three occasions one of the escort planes had to be left behind for repairs, with a rescuing plane to attend to it. Hawaii was reached at about ten o'clock P.M. by the Doctor's watch and San Francisco the next morning. Fortunately the Doctor's plane—"The Hoochie," his latest and best model, stood the trip well, and a brisk overhauling put it into proper condition for the final lap. Some slight delays ensued, but by running the machine at full speed, the Hoochie reached the landing place in New York a few seconds before six P.M., the scheduled time. They had made the trip in exactly eighty hours.

By traveling eastward they had been four days and eight hours on the trip, but the days (day and night included) were only eighteen hours long. Had they travelled westward in-

(*Continued on page 219*)

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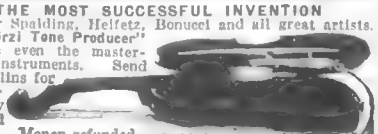

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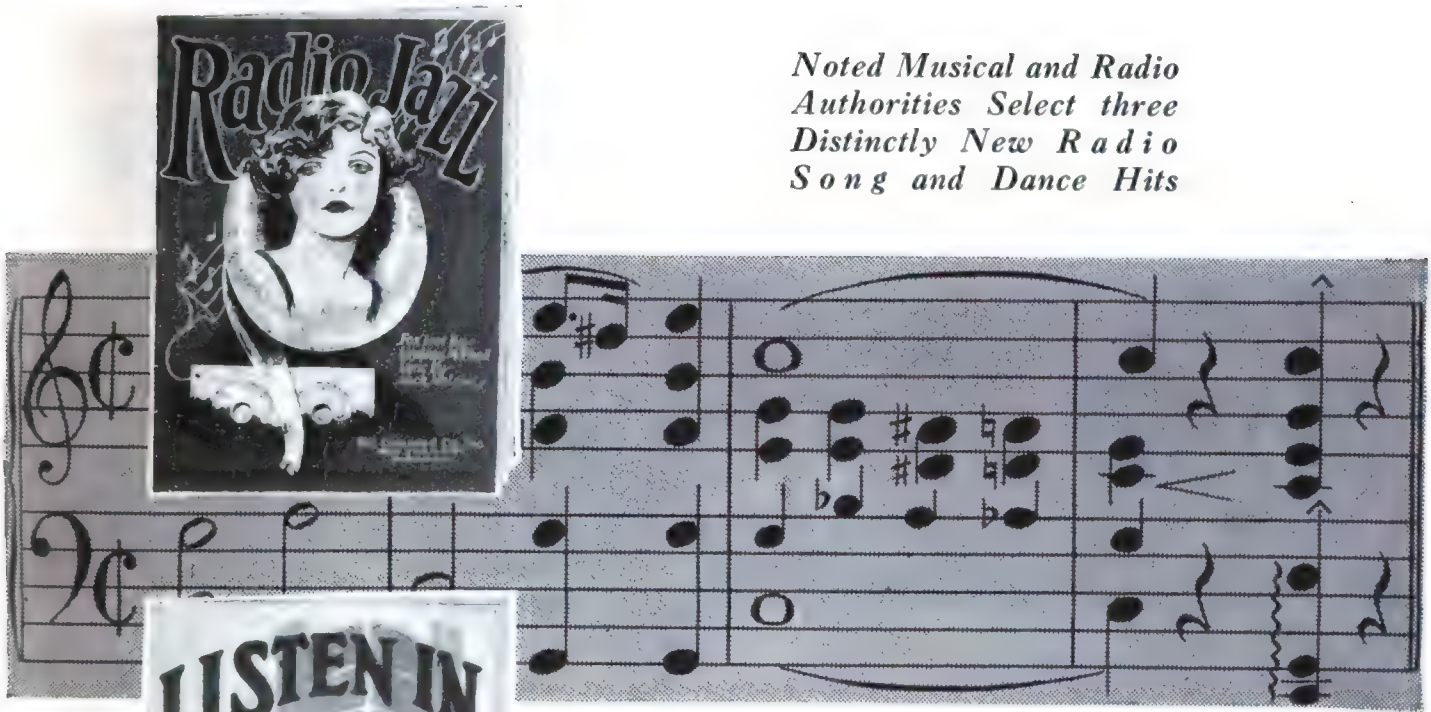

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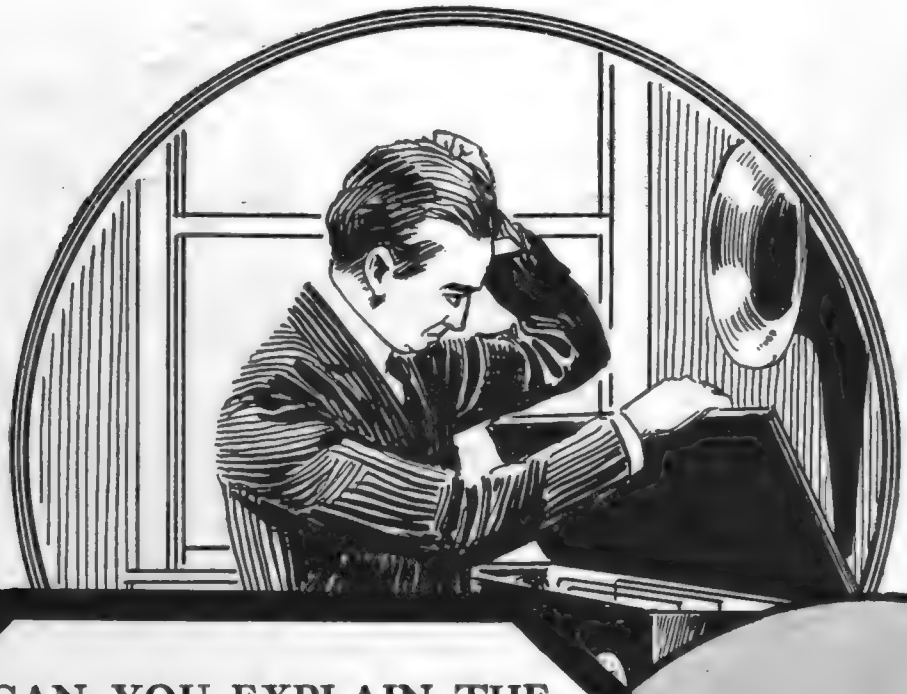

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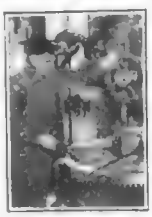

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Dr. Hackensaw's Secrets

(*Continued from page 216*)

stead, the trip would have lasted only two days and eight hours, but the days would have been 36 hours long; eighteen tedious hours of daylight followed by an eighteen hour night. In either case, of course, the total time would have been eighty hours.

Mr. Sharp was at the landing-place waiting for them, and he held in his hand a signed government order for fifty of the new airplanes as a sample.

"Well, Pep," cried Doctor Hackensaw, gaily. "We've made the tour of the world in exactly 79 hours, 59 minutes and 37 and three-tenths seconds! We had nearly twenty-three seconds to spare. It's a pity we didn't make use of this spare time to see a little more of the countries we passed through!"

"Yes," answered Pep, disconsolately. "It was a great waste of time. Just think of it! Here I've been all around the world and have come home without having had a single proposal—not even from a Chinese mandarin!"

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of SCIENCE AND INVENTION, published monthly at Jamaica, New York, for April 1, 1924.

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County of New York }

Before me, a notary public in and for the State and county aforesaid, personally appeared H. Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of the SCIENCE AND INVENTION and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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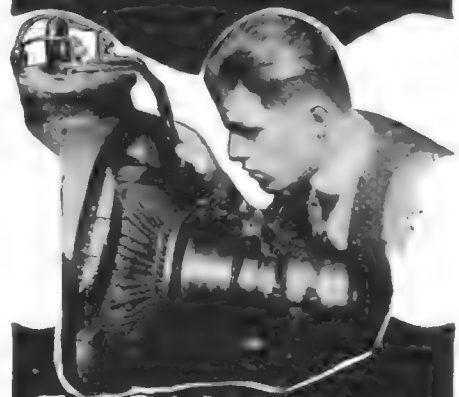

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PRACTICAL ELECTRICS is probably the most novel magazine of its kind ever conceived. It is personally edited by H. Gernsback, editor of SCIENCE & INVENTION, MOTOR CAMPER & TOURIST and RADIO NEWS. Mr. Gernsback, who founded the old "Modern Electrics" as well as the "Electrical Experimenter," knows thoroughly what his readers want and have wanted for many years. PRACTICAL ELECTRICS, the 100% electrical magazine, eclipses the best that was in "Modern Electrics" and "Electrical Experimenter."

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HIGH TENSION ARMOR
DETECTION OF ICEBERGS
INFRA RED LIGHT TELEPHONY
DEMOUNTABLE STORAGE BATTERY
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This magazine offers a number of prizes, as follows:
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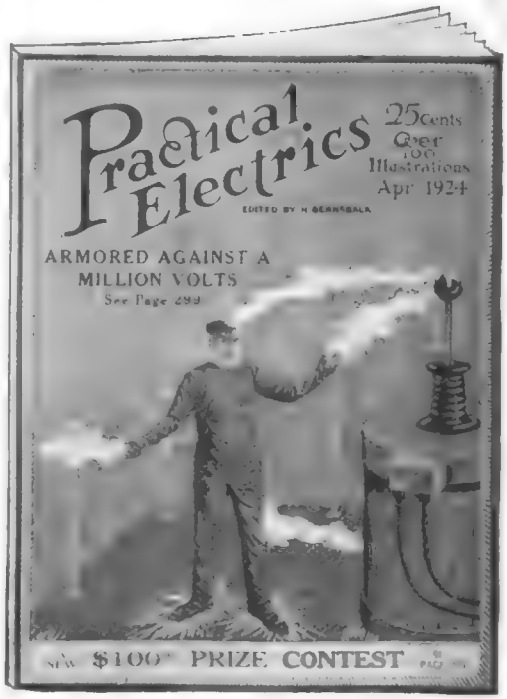

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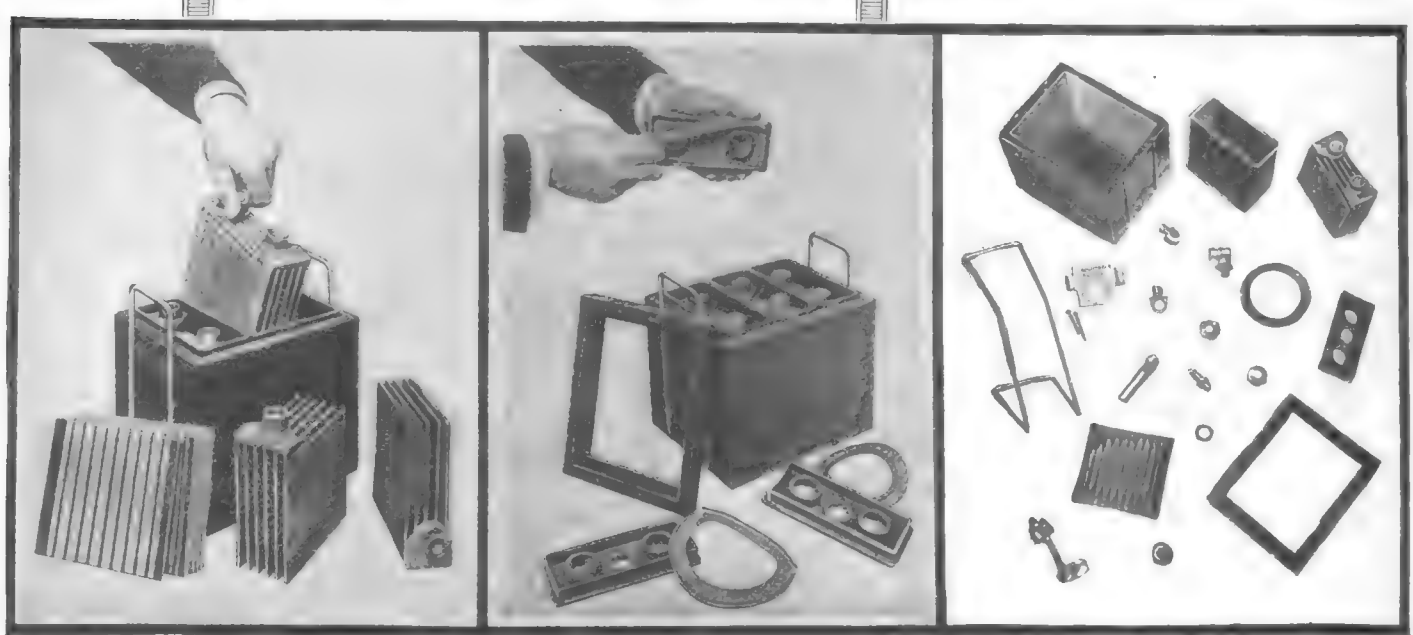

Demountable Storage Battery
A Novel Article appearing in the April Issue

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Advertisements in this section twelve cents a word for each insertion. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Ten per cent. discount for 6 issues, 20 per cent. discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the August issue must reach us not later than June 15th.

The Circulation of Science and Invention is over 177,000 and climbing every month

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Agents—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold. It vulcanizes itself in two minutes and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., Dept. 601, Philadelphia, Pa.

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$150.00 weekly, selling portable Radio Sets complete, no aerial required, operates anywhere, automobiles especially. Big value. County Managers, agents, write! Box No. 170, Science and Invention.

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Inventors—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information Free. Lancaster and Allwine, 242 Ouray Bldg., Washington, D. C.

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Build Your Phonograph. Quality phonoparts. Famous Serenado Motors. Also original Perfection Motors. Electric Motors, tonearms, reproducers, amplifiers, case material, accessories. Free blueprints and building instructions. Big saving. Wonderful results. Prompt delivery. Catalogue mailed for ten cents. Hoosier Mfg. & Supply Company, 321 Baldwin Block, Indianapolis, Indiana.

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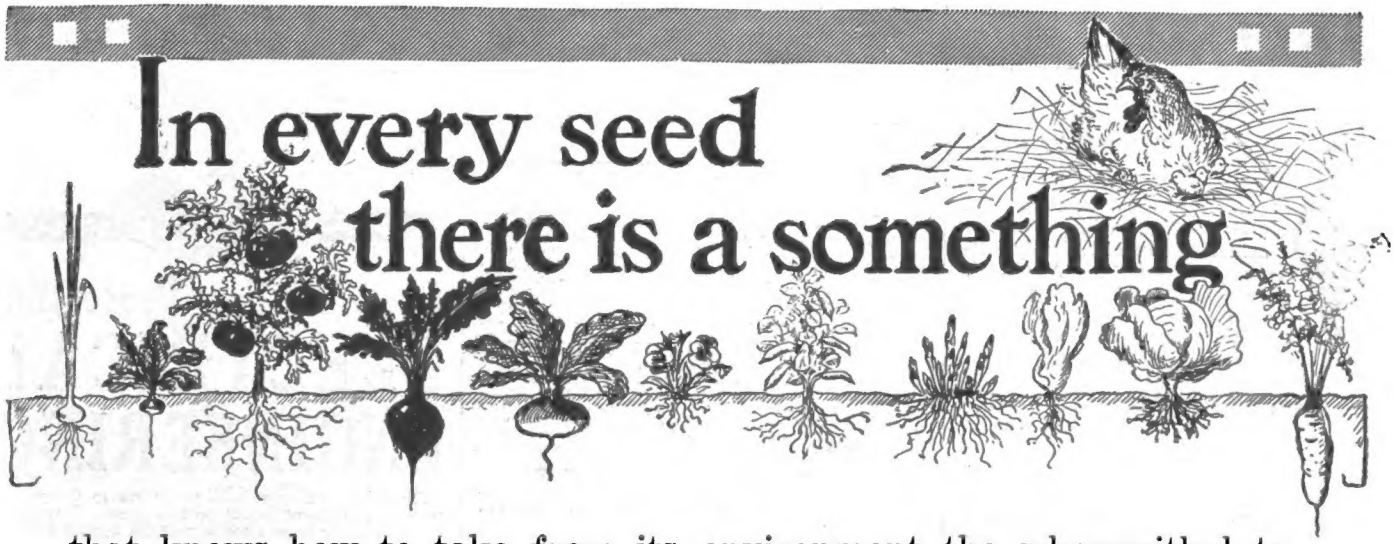

that knows how to take from its environment the wherewithal to build the body of the organism it animates. From the little seed you place in the ground this **something** sends roots into the earth, blades or branches into the air, and takes **from** the earth and the air that with which it builds.

Within the egg this **something** is wooed to life by the warmth of the brooding mother's breast.

CHIROPRACTIC

teaches that this **something** knows the secret of converting food into flesh and blood, and carries on all the processes of life, in the human body, by means of impulses sent over the nerves. It teaches that when a nerve is impaired by a vertebra becoming misaligned, these impulses do not flow over the nerves normally, and the result is what we call dis-ease. To get the dis-eased member to function again it is necessary to adjust the vertebra that is pressing on the nerve, to normal alignment, thereby permitting the normal flow of impulses over the nerve.

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